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### CARRYING COALS TO NEWCASTLE.

It might seem at first thought that an electrical distribution from steam-driven generators, operative in a territory supplied with gas and extremely cheap coal, would encounter commercial difficulties of an almost insurmountable character. Even a decade ago the supposition would have been painfully true, yet to-day in regular commercial work and on a businesslike basis the thing is being done, as the work in the Empire mining district, which we describe elsewhere, very plainly shows. This district lies in the Missouri and Kansas territory long known as the center of the lead and zinc mining industries. In the region are more than 600 mines in operation, varying from the holdings of big corporations to the little holes in the ground through which an industrious man has dug a small fortune out of his own back yard. This whole territory is now served by the Empire District Electric Company, which has in operation nine generating stations, nineteen substations, 100 miles of 33,000-volt transmission lines and an equal mileage of 2300-volt distribution circuits. It serves, besides, the running needs of a scattered community of more than 150,000 people and 165 miles of interurban railway. This service of itself is not remarkable, but that it should grow and prosper where gas can be had for 25 cents per 1000 cu. ft. and coal is somewhere about $2 per ton speaks volumes for the practical advantages of electric power.

Mining, however, involves peculiar conditions in the use of power, and experience has shown that under the circumstances of average use the power costs in mining run abnormally high. For instance, in one case of mine pumping it was found that even with fuel gas at only 12.5 cents per 1000 cu. ft. the actual fuel cost per 1000 gal. pumped rose to 4.8 cents. When the steam pump was discarded and an electric pump installed in its place the cost for the power fell to 8.3 mills per 1000 gals. In addition to more than 100 pumping installations, many motor-driven air compressors are in use, with hoists and other equipment, bringing the total connected motor load up to about 25,000 hp. The load curve of the system is unusual on account of the mining service, with a long peak from 9 a. m. to 3 p. m., rising to some 11,000 hp. Building up such a business is no easy matter, for, as usual, the users of power have no exact knowledge of its real cost, yet load is steadily being secured in spite of the very low nominal cost of fuel. One exceptional feature of the practice here is the very large use of 2300-volt induction motors, all above 30 hp being thus wound for the regular distribution voltage. Taken altogether, the system is a beautiful example of the adaptability of electric drive in the face of cheap gas and coal. In convenience and efficiency the electric motor wins on its merits, so that it can

be made to pay under competitive conditions at first thought quite hopeless. We have seldom seen so admirable a demonstration of the possibilities of electric power distribution.

### THE GENERAL ELECTRIC STOCK DIVIDEND.

It was a pleasant task for the stockholders of the General Electric Company, when they met on Aug. 29, to vote their approval of the stock increase from $80,000,000 to $105,000,000; for $23,000,000 of this stock is to be given to the present holders as a bonus amounting to $30 per share. With their shares selling at 150 ex the 30 per cent stock dividend, the General Electric shareholders will receive a gift having an aggregate market value of about $42,000,000, on which at the present rate they will receive dividends amounting to $1,850,000 annually. The plan to issue as needed $60,000,000 of 5 per cent debentures "for the future financial needs of the company" indicates the possibility of an even more liberal dividend policy than has been pursued in the past when needed funds have been obtained by the issuance of additional stock.

One of the first thoughts occasioned by the cutting of the General Electric "melon" is that it affords impressive evidence of the progress and prosperity of the electrical industry as a whole. This progress, in so far as it relates to the General Electric Company, was graphically exhibited in the financial review published in the *Electrical World* Aug. 3. The gross business of the company is now even larger than shown in that review, being considerably above $90,000,000 a year—a threefold increase over the sales of $32,000,000 in 1902. Ten years ago the company had a working capital of $23,000,000, cash on hand amounting to $4,000,000, 15,000 employees and a plant area of 2,500,000 sq. ft. To-day it has a working capital of $63,000,000, cash amounting to $20,000,000, 42,000 employees and 10,000,000 sq. ft. of floor space. Its net earnings last year were 13.6 per cent and in 1910 16.6 per cent on its capital stock. In this connection it is to be remembered that the asset column of the company's report includes only a nominal sum as representing its immensely valuable patents, trade-marks and good-will. Its book values of $20,000,000, after charging off nearly $8,000,000 in the past two years, stand for tangible, not intangible, assets. Twenty years ago the company entered its patents and rights at a valuation of $8,000,000. Now, when these rights are vastly more valuable, they are put down at $1 in the annual report. Compare this with the Sears, Roebuck Company's $30,000,000 of good-will, the Underwood Typewriter's $8,000,000 of patents, etc., and the enormous sums at which smaller industrials carry these items, and the General Electric bookkeeping is seen to be the extreme of conservatism.

Viewed statistically from any angle the position of the company warrants the stock increase voted and which it was announced is "in partial recognition of dividends which in prior years have been omitted or reduced." As to this, 7 per cent cumulative dividends on the preferred stock up to the time it was converted to common were all paid. With the exception of two years the common paid no dividends until 1899, but a distribution of $25,000,000 is far in excess of any amount that the common stockholders might in reason have received from 1894 to 1899. A better explanation, it would seem, is that the company has earned and reinvested $25,000,000, which is now to be turned over to the shareholders in the form of stock certificates. If its equivalent had not been invested in the securities of other companies, the distribution might already have been made in cash. Granting—and it appears to have been demonstrated—that this stock dividend satisfies the acid test of sound finance, there is little more to be said except by way of speculation upon what might have happened if, as some of our leading publicists advocate, we had the same regulation of great industrial companies that we now have, in many cases, of public-service corporations. Under those circumstances would an industrial commission, guided by the general rules applied to public-service companies, approve the General Electric stock distribution?

### ELECTRICAL APPARATUS FOR MEASURING POWER.

Power is essentially a double-component quantity. In the typical electric circuit it has for its components volts and amperes. In the typical case of translatory power the components are force and velocity. In the case of rotatory power the components are torque and angular velocity. In the direct-current electric circuit it is optional to measure power either by multiplying the readings of voltmeter and ammeter or to employ a wattmeter—a single instrument which indicates the power directly. In measuring mechanical power there is ordinarily no option; the two components must be measured separately, and the power is then obtained from their product. Prof. Charles R. Moore, however, describes in this number an ingenious electricial device for measuring mechanical power in the reading of a single instrument. This instrument is, therefore, an electrical wattmeter for measuring mechanical power.

The new method depends upon the vector sum of two co-frequent sinusoidal emfs. Each of the two component emfs is directly proportional to the angular velocity, and their resultant is, for any given speed, directly proportional to the torque, approximately; that is, within a correction ratio of the sine of an angle to the angle itself. Over a reasonable range of small to moderate angles this correction is relatively small, and by changing the spring coupling the range of available torque may be extended as far as may be necessary. Such a device, after being duly calibrated, gives the mechanically transmitted power as the reading of one alternating-current voltmeter connected in circuit with the two armatures.

For many engineering purposes such a direct-reading device might offer considerable advantages. The limitation of wattmeter range without changing springs would seem to be the least favorable attribute. The power consumed in the device itself need be only a very small fraction of the power delivered, and the principle on which the device operates is a very interesting one. In cases, however, where the transmitted mechanical power must be measured with the greatest possible precision it remains to be shown whether greater accuracy cannot be secured by independent measurements of torque and velocity than by a compounding device of this character, since corrections of several different types have to be taken into account.

**THE BUSINESS SITUATION.**

The general tone of optimism in reference to the business situation and trade in general, which appears to be widespread, excites considerable comment in the face of a complex political situation. It has long been a tradition that business marks time during Presidential campaigns, but contrary to expectations there seems to be a rising wave of business activity, even in the face of national political conditions quite as uncertain and complex as we have seen for two decades. Agricultural prosperity lies at the foundation of our national well-being and the prospects for large crops this year are excellent. Other indications, such as gradually increasing bank clearings, predictions of a car shortage among the railroads, increasing net earnings of public-utility companies and a larger volume of unfilled orders among industrial concerns, all point to the same general conclusion. Moreover, we have passed sufficiently beyond the 1907 panic to expect that the succeeding retrenchment ought now to commence yielding tangible results. In order, however, that we may not assume a degree of complacence over the situation which is unwarranted, it will pay to remember that we have still with us the high cost of living, an inequitable tariff and an obsolete currency system.

The electrical industry, in particular, shares the optimism which seems generally to prevail. The large manufacturers report a good volume of business and more unfilled orders than a year ago. The chief note of complaint arises over low prices, which of itself is a good sign when viewed in the light of events since the panic and the history of the rise and fall of business. Evidently we are near that point in the cycle of trade changes where price cutting, succeeding a period of distress and inactivity, is commencing to show results in stimulating business. Contractors, jobbers and supply dealers report a satisfactory volume of trade, but complain that with the low prices and keen competition prevailing they must do considerably more business than last year to earn equal net profits. The lamp business is also reported as excellent. Many new projects and developments are under way and the public utility companies are constantly making needed extensions. The copper situation, although the market price is altogether high enough—possibly too high—is affected by a reduced supply of the metal as compared with last year. A further rise in price, lately predicted, will not be a good thing, as a whole, for the industry, because it is certain to react and swing upward the prices of all electrical goods at an unhealthy rate. This always adds zest to the search for substitutes for copper, and each upward swing in the cycle of prices serves to establish more firmly in general usage any substitutes available, and emphasizes the great possibilities of aluminum under a lower tariff.

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**A STUDY OF CENTRAL-STATION DESIGN.**

The attention of those of our readers who are particularly interested in central-station work should be directed to a paper by Mr. G. Klingenberg, briefly abstracted in the *Digest* of our issues of Aug. 10 and 17 and again this week. The original papers should be particularly commended to those interested in the design of large central stations as showing the trend of foreign practice. The point on which the author lays particular stress is the design of the station with reference to meeting conditions imposed by the load-factor. Some interesting examples of typical load distributions point the moral thus drawn, and the bearing of the load distribution and the efficiency characteristics of the generating sets under various load conditions are gone into with far greater detail than is usual in studies of this kind. In the matter of station design the very general use of the horizontal type of turbine in European stations produces some interesting modifications in arrangement which, in view of the increasing employment of the horizontal type in this country, will repay study on the part of the American engineer. Continental practice also tends toward steam-driven auxiliaries rather than the electrically driven auxiliaries of American practice, the objection to the latter, in spite of their higher efficiency, being the interpolation of another link in the chain of energy delivery which may at times prove a weak spot in the regular operation of the system.

The steam generating equipment is somewhat elaborately investigated in the articles in question, and a very telling diagram is given of the temperature characteristics of the steam-producing system. The fact is that the generating units have as a general proposition quite outrun the steam-producing units in the race for economy, and Mr. Klingenberg's discourse on the boiler room, its losses and the means of diminishing them is particularly worth studying. It is undoubtedly true that the next great step in central-station economy, as regards both construction and operation, will be in the more efficient use of boilers. Larger units, such as have been tried at Detroit, or units worked far more intensively than at present, will result in either case in the production of steam at higher efficiency and with greater economy of space than is now the rule. An improvement of 10 per cent or more in the efficiency of the prime mover everyone recognizes as worth struggling for, and yet it is perfectly certain that gains greater than this can be made in boiler efficiency when attention is more effectively concentrated on that feature of the central station.

The last part of the paper under discussion is taken up with an investigation, enriched by many diagrams of performance, of the bearing of power transmission on station economics; that is, the relation between transmission costs and those imposed by the transportation of fuel as such. As central stations grow larger and larger and the central-station business takes on its widest aspects, the transmission problems become more and more serious and critical. It seems altogether probable that the central-station system of the future will pass in the scope of its distribution the limits of economical generation in a single station and will consist of a group of stations so proportioned and distributed as to bring the network efficiency to a maximum. With our present tendencies toward high voltage and the utilization of cheaper and cheaper fuel the constant tendency must be toward increase of dimensions of a central-station distributing network and an increase in the gain of electrical transmission over the transportation of fuel. The phase of the general problem, therefore, which deals with the balancing of these two methods of supply, if one may call them so, is an extremely important one.

## LAUNCHING OF THE U. S. COLLIER "JUPITER."

The United States collier *Jupiter*, the first electrically driven seagoing vessel ever built, was launched at the Mare Island Navy Yard on Aug. 24. This vessel is also said to be the largest ship of any kind ever laid down on the Pacific Coast. The details of the propulsion equipment for the *Jupiter* were described in the *Electrical World* of Aug. 3, page 251. This twin-screw vessel will be driven by a pair of induction motors which receive their energy from a variable-speed turbo-generator. In our June 1 issue, page 1148, there was a comparison of the rating and performance of the *Jupiter* with those of her sister ships *Neptune* and *Cyclops*, the former turbine-driven and the latter engine-driven. It is reported that the *Jupiter* will not be ready for her trials until about next May.

## DECREE IN THE LINCOLN HIGH-TENSION CASE.

The Circuit Court of Logan County, Ill., Judge Harris presiding, has handed down a decree in the case of the American Telephone & Telegraph Company versus the Springfield & Northeastern Traction Company, the opinion in which was abstracted in our issue of last week. The court found that the overbuilding of the complainant's telephone line in Lincoln by the defendant's 33,000-volt, three-phase transmission line created a condition of unreasonable danger and was not approved or proper construction. Furthermore, the court found that this overbuilding endangered life and property through the lack of approved safeguards and protective devices and the resulting possibility of mutual contact between the two systems. The defendant, which is one of the companies comprising the Illinois Traction System, has been permanently enjoined from using the section of high-tension line in question until reasonable safeguards and protective devices are installed. Counsel for the defendants have taken exception to the findings of the court, but whether an appeal will be taken has not yet been announced.

## PHILADELPHIA ELECTRIC COMPANY SECURES 26,200-KW RAILWAY LOAD.

The Philadelphia Electric Company has signed a contract with the Philadelphia Rapid Transit Company for a railway load of 26,200 kw. Some of the operating stations of the Rapid Transit Company will, as a consequence, be shut down or converted into substations to be operated by the Philadelphia Electric Company, which is required to supply direct current in some locations. For this purpose these stations are leased at a nominal rental, and the electric light company has the privilege of operating them in case there should be any trouble with its converting apparatus.

The load is covered by three separate contracts, known as the "Central contract," the "Northern contract" and the "Delaware County contract." The Central contract covers high-tension alternating-current energy and does not entail any operating expense whatsoever upon the Philadelphia Electric Company. This energy is delivered to the substation of the Philadelphia Rapid Transit Company at 812 Sansome Street and at a substation at Twentieth and Ranstead Streets now being built and which will be occupied jointly by the electric light and rapid transit companies. This contract calls for 15,000 kw, and 5000 kw additional to be delivered by Nov. 1, 1913, at a new substation yet to be determined.

The Northern contract calls for energy for a 5000-kw direct-current load, and the substation apparatus, as well as the operating force for the same, must be supplied by the electric-light company. It is the intention to supply this energy from the Tacony station of the Philadelphia Electric Company to the stations of the Rapid Transit Company at Ogontz, Willow Grove, Neshaminy and Wheel Pump (Chestnut Hill). In order that the electric-light company may carry out its part of its contract, the stations named will be occupied at a nominal rental and the company will also have the privilege of utilizing the generating apparatus in all of them if it so elects.

The Delaware County contract is made with the Delaware County and Beacon subsidiary companies of the Philadelphia Electric Company and calls for 1200-kw direct current, which can be furnished either from Philadelphia or from the Beacon light company's station at Chester, Pa. The direct-current energy will be furnished from the electric-light company's own substations at Media and Chester, and the electric-light company will occupy the Rapid Transit Company's substation at Folsom at a nominal rental. The Rapid Transit Company guarantees on the Central and Delaware County contracts a 35 per cent load-factor, and a 30 per cent load-factor on the Northern contract. All of the contracts are for a period of ten years, and by Nov. 1, 1913, the Philadelphia Electric Company will be carrying a load of 26,200 kw for the Philadelphia Rapid Transit Company.

## DECISION IN DES MOINES GAS CASE.

On Aug. 21 Judge Smith McPherson, of the United States District Court for the Southern District of Iowa, handed down a decision sustaining the findings of Special Master Sloan in the Des Moines gas case, which, because of its bearing on the principles of rate making, possesses special interest. By the terms of this decision it is held that a rate of 90 cents per 1000 cu. ft. is remunerative to the Des Moines Gas Company. This suit grew out of the passage of an ordinance by the City Council on Dec. 27, 1910, reducing the price of gas in Des Moines from $1 to 90 cents per 1000 cu. ft. A temporary injunction was secured in the federal court by the gas company, preventing the enforcement of the ordinance on the ground that the company's business would not be remunerative if the price of gas were reduced as contemplated.

Judge McPherson stipulated that the 90-cent rate should be given a three-year trial. If at the end of that time the company finds that its business is not remunerative at that price, it has the privilege of reinstating the case and endeavoring to secure a higher rate. The gas company is allowed sixty days in which to prepare for the change in rate. The City Council was criticised in the decision for the hasty manner in which the ordinance was adopted. The judge also remarked that much litigation of this character could be avoided if Iowa, like many other states, had a public service commission. "Too often," said the court, "we have selfish, partisan, prejudiced and unreliable experts engaged for weeks at a time, at $100 or more and expenses per day, exaggerating their importance and making the successful party in fact a loser." It is recommended that the power of rate making be taken from city councils in Iowa.

The court declared that the gas company's reproduction theory for determining the value of its plant in Des Moines is a fallacy. The company attempted to prove the value of its plant by estimating what it would cost to reproduce it. In many instances its mains are laid in streets which have been paved since, and the cost of removing and relaying paving was included as a part of duplicating the plant. Judge McPherson held that this is not a fair method of arriving at the value of the present plant. "Good will" is another item which is held not to be an element of value on which profits should be earned. The present value is the basis on which returns are to be

estimated, and good will does not enter into the equation. Out of a total value of $2,240,928 the master allowed $300,000 for intangible value; the court held that this was sufficient, although the company made a strenuous plea for a larger allowance. The case has attracted wide attention, and many well-known public utility experts testified at the hearings.

## A. I. E. E. AFFAIRS.

For some time past the board of directors of the A. I. E. E. has desired to promote closer relations between the Institute and foreign electrical engineering societies. The advantages of a closer understanding were evident last year, when so many Institute members went abroad to attend the International Electrical Congress at Turin and the meeting of the International Electrotechnical Commission. On receiving the report of Mr. Gano Dunn, who as president of the Institute headed its delegations to both of these meetings, the board, feeling that it would not only promote the convenience of visiting engineers both in this country and abroad but would also increase the friendly relations created by the activities of the International Electrotechnical Commission and other similar agencies, passed the following resolution:

"*Resolved*, That the president is authorized to communicate with certain leading foreign electrical engineering societies with respect to establishing mutual visiting-member privileges for a limited term, with the end in view of contributing to the convenience of our own members visiting foreign countries, and in return affording corresponding conveniences to members of foreign electrical engineering societies visiting the United States, and of increasing the friendly relations between American and foreign electrical engineers."

Accordingly a number of European electrical engineering societies were communicated with by President Dunn, and the following have cordially accepted the Institute's proposals to enter into reciprocal arrangements for the mutual benefit of the members of the respective societies: The Institution of Electrical Engineers (Great Britain), Verband Deutscher Elektrotechniker (Germany), Société Internationale des Électriciens (France), Associazione Elettrotecnica Italiana (Italy), Koninlijk Instituut van Ingenieurs (Holland), Association Suisse des Électriciens (Switzerland). The Svenska Teknologforeningen (Sweden) will take up the question at the meeting of its governing body in the fall.

The arrangements entitle members of the A. I. E. E. while abroad to the privileges of members of the societies designated for a period of three months, and foreign members visiting this country are entitled to the privileges of Institute membership for a like period. To foreign engineers visiting this country it is proposed to give, upon presentation of proper credentials, letters of introduction to Institute members and to officers of manufacturing and operating companies; also to place at the disposal of visitors the facilities of the library, in which are a large number of books in foreign languages, and the reception, reading and writing rooms at Institute headquarters.

There has been prepared for the use of Institute members while abroad a form of certificate to be signed by the secretary, which will serve as credentials from the Institute to foreign societies. Any Institute member in good standing intending to go abroad may obtain such certificates upon application to the secretary, a separate certificate being necessary for each foreign society. The visiting-member privileges involve no expense, either to Institute members or to foreign members, and the advantages which they offer have commended them to the favorable consideration of all the organizations concerned. They are undoubtedly a step toward bringing the electrical engineers of Great Britain, Europe and America more closely together.

Through the generosity of Past-president Gano Dunn, the Institute has been enabled to add to its historic collection an admirably executed bronze bust of the distinguished scientist Joseph Henry, taken from the life-size statue of Henry in the Smithsonian Institution at Washington. The Institute at its annual meeting last May presented a similar bust to the Associazione Elettrotecnica Italiana, as an evidence of its appreciation of the cordial hospitality shown by the officers and members of that association to the representatives of the United States attending the International Electrotechnical Commission at Turin last fall. The bust recently received at Institute headquarters and the one presented by the Institute to the Italian society were reproduced under the supervision of the distinguished sculptor of the original in the Smithsonian Institution, Mr. Herbert Adams, of New York.

## NEW ENGLAND SECTION N. E. L. A. CONVENTION PLANS.

The fourth annual convention of the New England Section of the N. E. L. A. will be held at Boston, Mass., on Oct. 15, 16 and 17. The meetings will be held in the Mechanics' Building in connection with the Boston 1912 Electric Show, which will occupy the premises from Sept. 28 to Oct. 26, and it is planned to invite the entire membership of the association to the New England gathering in order to give those who were unable to go to Seattle last spring an opportunity to attend what will probably be the largest geographical section meeting ever held and at the same time to visit the Electric Show. The program contains seven papers and many other attractions for members and guests in attendance.

## PROGRAM OF SEPTEMBER MEETING OF AMERICAN ELECTROCHEMICAL SOCIETY.

The twenty-second general meeting of the American Electrochemical Society will be held at Columbia University, New York City, Sept. 7, 9 and 10, in joint session with Section X(a) of the Eighth International Congress of Applied Chemistry. The general topic of the session to be held on Saturday morning, Sept. 7, will be electrometallurgy. The Saturday afternoon session will be held at the American Museum of Natural History, Seventy-seventh Street and Central Park West, where the subjects of electrochemistry and physical, inorganic and agricultural chemistry will be the topics under consideration. Tuesday morning's session will take up the subject of paper, and the afternoon session will consider the question of conservation. Registration will be handled in connection with Section X(a) of the congress. A provisional program has been arranged as follows:

Saturday morning, Sept. 7: "Heat Losses in Furnaces," by Mr. F. A. J. FitzGerald; "Electrolytic Induction and Resistance Furnaces," by Mr. C. H. von Bauer; "Recent Developments of the Electric Steel Furnace," by Mr. P. Heroult; "Electric Heating and the Removal of Phosphorus from Iron," by Mr. A. E. Greene; "The Function of Slag in Electric Steel Refining," by Mr. R. Amberg; "The Electric Smelting of Zinc Ore," by Mr. F. T. Snyder; "Extraction of Copper from Sulphide Ores by Roasting, Leaching and Deposition," by Mr. J. O. Handy; "Cathode Impurities in Copper Refining and Their Sources," by Mr. L. Addicks. Saturday afternoon: Address on "Oxidation of Atmospheric Nitrogen and Development of Resulting Industries in Norway," by Mr. Samuel Eyde, of Christiania, Norway.

Monday, Sept. 9: "Electrolytic Dissociation," by Mr. E.

H. Loomis; "Die Physikalische Natur von Bioelektrischer Potentialdifferenzen," by Mr. R. Beutner; "The Vapor Pressure of Amalgams," by Mr. J. H. Hildebrand; "The Relation Between the Potential of Liquid Amalgam Cells and the Constitution of the Amalgam," by Mr. J. H. Hildebrand; "Mineral Electrodes," by Mr. R. C. Wells; "The Silver Coulometer," by Messrs. G. A. Hulett and G. D. Buckner; "Inclusions and Impurities in Electrolytic Silver," by Messrs. J. S. Laird, G. D. Buckner and G. A. Hulett; "A Cadmium Coulometer and the Electrochemical Equivalent of Cadmium," by Messrs. J. S. Laird and G. A. Hulett; "Coulometer Research," by Mr. G. B. Frankforter; "Étude des Propriétés Magnétiques des Alliages du Fer, du Cobalt, du Nickel et du Manganèse avec le Bore," by Mr. B. du Jassonneix; "The Reduction of the Chlorides of Titanium, Carbon, Silicon, Beryllium and Neodymium by Metallic Sodium," by Mr. M. A. Hunter; "Unnatural and Artificial Sulpho-Antimonites and Sulpho-Arsenites," by Mr. Jaeger; "Équilibres des Systèmes Eau-azotite de Soude," by Mr. M. Oswald; an experimental lecture on "The Element Boron, Its Compounds and Uses," by Mr. W. Weintraub.

Tuesday, Sept. 10: "Factors Controlling the Cost of Sodium Hypochlorite Production," by Messrs. W. H. Walker and R. E. Gegenheimer; "Recent Progress in the Electrolysis of Alkaline Salts," by Mr. E. Wilderman; "Process for Manufacturing Alkali and Chloride-Resistant Ebonite," by Mr. E. Wilderman; "Nouvelle Contribution à la Théorie des Électrolyseurs à Diaphragmes," by Mr. Ph. A. Guye; "Mechanical Depolarization in Electrolytic Cells," by Mr. Alan A. Chaflin; "Die Industrielle Chlorgasverwertung," by Mr. Rud. Taussig; "Commercial Development of Industrial Processes," by Mr. Jasper Whiting; "Our National and State Governments in Relation to Mineral Waste," by Mr. J. A. Holmes; "The Extent of the Iron and Steel Industry in the United States," by Mr. J. Birkinbine; "Power Supply Characteristics of the Electric Furnace," by Dr. C. P. Steinmetz; "Study of a Small Carborundum Furnace," by Messrs. W. D. Bancroft, L. V. Walker and C. F. Miller; "Determination of Oxygen in Iron and Steel by Reduction in an Electric Vacuum Furnace," by Messrs. W. H. Walker and W. A. Patrick; "Action of Nitrogen on Strontium Carbide," by Messrs. S. A. Tucker and Y. T. Yang; "The Electrochemical Behavior of Very Concentrated Liquid Thallium Amalgams," by Messrs. Theo. W. Richards and T. Daniels; "Electrolytic Nickel Solutions," by Mr. O. P. Watts; "Quantities of Carbon as Influencing Dry-Cell Construction," by Mr. Carl Hambuchen.

The following papers are promised by the American Institute of Mining Engineers, to be presented at the joint sessions on Friday and Saturday: "The Decomposition of Metallic Sulphates at Elevated Temperatures in a Current of Dry Air," by Mr. H. O. Hofman and Mr. Wanjukoff; "Some Metallographic Notes," by Mr. William Campbell; "The Carbon-Iron Diagram," by Mr. Henry M. Howe; "A Novelty in Open-Hearth Furnace Practice," by Mr. N. S. MacCollum; "Blowing-in of Blast Furnaces," by Mr. Ralph H. Sweetser; "The Manufacture of Coke," by Messrs. F. E. Lucas, W. H. Blauvelt, C. W. Andrews and J. De Forrest; "The Influence of Titanium on the Strength of Iron Castings," by Mr. Bradley Stoughton; "Cuyuna Iron Ore Range," by Messrs. Walter A. Barrows, Jr., and Carl Zapffe; "The Case-Hardening of Special Steels," by Messrs. Albert Sauveur and G. A. Reinhardt.

The following additional papers have been promised by members of the American Electrochemical Society, but cannot be assigned before the announcement of the final program: "Electric Furnace Alloy Steels," by Messrs. J. A. Matthews and M. T. Lathrop; "The Electrical Resistivity of Fire Bricks at High Temperatures," by Mr. A. Stansfield; (1) "Radiation and Convection of Heat," and (2) "Calculation of Flow of Heat Through Bodies of Various Shapes; "Experimentation and Theoretical Determination of the 'Shape Factor,'" by Mr. Irving Langmuir; "The Electric Furnace for Heating Steel for Forging," by Mr. Thaddeus F. Bailey; "Electric Furnaces in Metallurgy of Steel," by Mr. A. E. Greene; "Fixation of Atmospheric Nitrogen by Alumina and Carbon," by Messrs. S. A. Tucker and H. L. Read; "The Electrolytic Refining of Silver Bismuth Alloys," by Mr. William N. Lacey.

## BOSTON INFORMATION BUREAU TRANSFERRED.

The headquarters of the Boston Co-operative Information Bureau have been transferred from the library of Stone & Webster to the Massachusetts Institute of Technology, Boston. The bulletins of the organization will hereafter be published in co-operation with other sources of printed matter, with a subsequent yearbook which will be an amplification and revision of the series. The bureau is becoming a factor in the interchange of engineering, scientific and commercial information in the Boston district.

## CELEBRATION ATTENDING THE INSTALLATION OF LUMINOUS-ARC LAMP STANDARDS IN UTICA, N. Y.

The lighting of the luminous-arc lamp standards in Utica, N. Y., last week was made the basis of a public celebration. The installation, which is fed from the circuits of the Utica Gas & Electric Company, consists of sixty inverted-type General Electric luminous-arc lamps rated at 6.6 amp and installed on cast-iron posts spaced 85 ft. apart along both sides of Genesee Street, from Bagg Square to the first block above the city hall, a distance of about one-half mile. The lamps were installed at the expense of the merchants and business men along this section of the street, and their maintenance after Jan. 1, 1913, will fall to the city of Utica under the regular contract for street lighting. The order from the business men's committee was placed with the Utica Gas & Electric Company on July 17, and the lamps were started for commercial operation on the evening of Aug. 20. The Ornamental Lighting Pole Company, of New York, furnished the standards, which were cast by Munson Brothers Company, local founders and machinists of Utica. The installation has already attracted a great deal of attention and comment, and inasmuch as the street is one of the widest and best known in the State of New York, it will undoubtedly prove not only a feature of considerable interest but add to the attractiveness of the business district of Utica as well.

## CONVENTION PROGRAM OF THE PENNSYLVANIA ELECTRIC ASSOCIATION.

The fifth annual convention of the Pennsylvania Electric Association (State Branch N. E. L. A.) will be held at the Bedford Springs Hotel, Bedford Springs, Pa., from Sept. 3 to Sept. 6. The convention will be opened with a reception to the president, Mr. R. S. Orr, Pittsburgh, on the evening of Sept. 3, and the regular business of the convention will be taken up the next morning. The opening session will be devoted to reports of the various standing committees, and, as has been the custom heretofore, no afternoon sessions will be held. The session on Sept. 5 will be addressed by Messrs. F. M. Tait and T. C. Martin, of the National Electric Light Association, and a paper and demonstration of the Schaefer prone-pressure method of resuscitation from electric shock will also be given at that session by Dr. C. A. Lauffer, Pittsburgh. The following papers are scheduled for presentation: "Dollars and Factors," by Mr. C. J.

Russell, Philadelphia; "The Wiring of Already-Built Houses," by Messrs. J. E. McKirdy and Howard H. Wood, Pittsburgh; "Welfare Work," by Mr. B. F. Day, Philadelphia; "Automatic Feeder Regulators for Out-of-Door Service as Applied to Single-Phase Lighting Circuits," by Mr. F. W. Shackleford, Schenectady; "Purchased Power: Its Advantages Versus Its Cost," by Mr. A. E. Rickards, Pittsburgh, and "Power-Factor: Its Effects on Operation and a Means for Its Improvement," by Mr. F. N. Jewett, St. Louis.

Entertainment features have been provided for the afternoons and evenings of convention week, in addition to entertainments exclusively for ladies on the mornings of Sept. 4, 5 and 6. A golf tournament and ball game will be provided on the afternoon of Sept. 4. In the evening a vaudeville and moving-picture performance, followed by dancing, will be given. The convention dinner will take place on the evening of Sept. 5, and a golf match between central-station members and associate members will take place on the afternoon of Sept. 6. Class D members of the association will have an opportunity to make a collective exhibit of apparatus, etc., in a room immediately to the rear of the convention hall and on the piazza adjoining. Mr. W. E. Long, 1000 Chestnut Street, Philadelphia, is secretary of the association.

## HYDROELECTRIC POWER FOR HALIFAX, N. S.

Plans are under way by the Nova Scotia Power Company, Kentville, N. S., for the construction of a hydroelectric plant at White Rock, at the head of the Gaspereau Valley, for the supply of electrical energy to Halifax and the towns of Kentville, Wolfville, Windsor, Canning and Middleton. The project calls for the utilization of a drainage area of about 160 sq. miles on the so-called South Mountain watershed, lying from 50 to 75 miles west of the city of Halifax, and includes the interconnection of a double chain of reservoirs and lakes and the construction of a main dam at the foot of Gaspereau and Murphy Lakes, with canal and flume facilities connecting with Little River Lake and the power-house site. About 3 miles of canal and 5 miles of flume are to be built, and the developed head at the generating plant is to be about 475 ft. A steel penstock about 2000 ft. long will be installed at White Rock, with a forebay at the top. About twenty lakes are involved in the storage scheme and the total power available is estimated at 18,000 hp with the ultimate development. The principal dam will be at Beaver Brook, and it will be about 6000 ft. long and 25 ft. in height. According to present plans, a 60,000-volt, steel-tower line will be built between the power house and Halifax. The intermediate territory is now supplied with electrical facilities from a number of small and relatively inefficient steam plants giving no day service. These will be shut down entirely and a considerable agricultural business will be established, including the operation of numerous apple and potato hoists in the Annapolis and Cornwallis valleys, the former crop averaging from 1,000,000 to 1,500,000 barrels per year. Negotiations are at present under way for the utilization of a substantial amount of energy in Halifax.

## PUBLIC SERVICE COMMISSION NEWS.

### NEW YORK COMMISSION, SECOND DISTRICT.

Mr. W. S. Connolly, of Hamilton, Ont., president of the New York & Ontario Power Company, recently appeared before the commission in response to an order to show cause why the company should not be required to put its plant in the village of Waddington, St. Lawrence County, in safe and proper condition. An engineer of the commission discovered that the overhead distribution system was in a generally dilapidated condition, many poles were so rotted they might be expected to fall down during the coming winter, if not earlier, and the entire system was in a deplorable condition. Mr. Connolly admitted that all of the criticisms of the engineer were justified and said that his company had leased the plant in the village to an individual who had agreed to keep it in condition. He agreed immediately to commence reconstruction of the plant and to carry on the work until it was placed in first-class condition.

### MARYLAND COMMISSION.

Hearings continue before the Public Service Commission in the investigation of the gas and electric rates charged by the Consolidated Gas, Electric Light & Power Company, of Baltimore. Mr. Herbert A. Wagner, vice-president of the Consolidated company, testified recently that in order to finance improvements and extensions in the electrical department this year it will be necessary for the company to add $1,000,000 to its present capitalization of $44,000,000. Mr. Wagner stated that it was the intention of the company to apply to the commsision for authority to issue these additional securities as soon as the market conditions made it advisable. He also declared that the present investigation had already disturbed the market value of the company's securities severely. His announcement concerning the additional capital required was made partly in justification of the amounts allowed by the company's experts for working capital. While this allowance of $750,000 has already been set aside for extensions made this year, he explained, it will be necessary in the next three months to contract for $250,000 more. This money has been borrowed from the banks but will have to be repaid from the sale of new securities. Mr. Wagner concluded by stating that at the rate new extensions to the electric system are now acquired it will be necessary for the company in the next ten years to issue $13,000,000 additional common stock to finance the demands.

### WISCONSIN COMMISSION.

As a result of an investigation by the commission, on its own motion, into the rates, rules and regulations of the lighting and power companies of Milwaukee, namely, the Milwaukee Electric Railway & Light Company, the Plankinton Electric Light & Power Company, the Commonwealth Power Company, the Wells Power Company, the Railway Exchange Building Company, the Colby & Abbott Building Company and the Mohler & Hummell Realty Company, the commission has issued an order requiring the first four named companies to adjust their rates to a uniform basis and to revise their rules and regulations so as to conform with the policies laid down by the commission. The investigation was originally begun in connection with complaints as to rates and rules, but conditions were disclosed which warranted the commission in making a more thorough investigation of all the lighting and power companies in the city. It was found that at least one of the companies, namely, the Commonwealth Power Company, had, in order to secure new business, resorted to practices which were discriminatory and which had brought about a situation that verged upon a destructive rate war. It appeared that the Commonwealth Power Company, for one, had indulged in a questionable manipulation of its rate schedules whereby certain prospective consumers were offered lighting service at the rates for motor service. Furthermore, discrimination had been practised in billing several individual consumers on one monthly bill and by furnishing fixtures free or at a price considerably below cost.

In its final opinion, the commission took occasion to point out the evils of competition in the public utility business as well as the consequences which result from so much duplica-

tion of equipment. Since the city of Milwaukee has seen fit to permit the existence of so many electric utilities, the commission, in conformity with its established policy of preventing ruinous competition, has attempted to save the situation by wiping out all discrimination and by requiring certain of the companies in question to abandon their rate schedules applying to the business district and to adopt a uniform schedule as devised by the commission. According to the order, the charge for electric service is to be computed on the following basis: Demand charge, $42 per year for each kilowatt of demand for the first 10 kw; $30 per year for each kilowatt of demand of the next 50 kw, and $24 per year for each kilowatt of demand in excess of 60 kw. This charge is to be payable in equal monthly instalments, plus an energy charge as follows: Four cents per kw-hr. for the first 1000 kw-hr. consumed during any month; 3 cents per kw-hr. for the next 3000 kw-hr.; 2 cents for the next 6000 kw-hr., and 1.5 cents per kw-hr. for all energy consumed in excess of 10,000 kw-hr.

To avoid all misunderstandings, the commission has classified the service into electric lighting, power and combined lighting and power. It is specified that "electric lighting service shall include electric energy furnished for lamps and other appliances utilized for illumination purposes, except as hereinafter specifically exempted; motors and appliances other than lighting equipment when provided with a starting device designed to limit the starting current to a value not exceeding two and one-half times the full load current; alternating-current motors of 0.25 hp when wound for 110 volts, and of 0.5 hp when wound for 220 volts, and direct-current motors of 1 hp; the aggregate rated capacity of such appliances, not to exceed 2 kw, will be included in this class when used in connection with lighting equipment and when the connected load of such motors and appliances does not exceed the aggregate rated capacity of the lighting equipment." It is specified that power service shall include electric energy utilized for motive and heating purposes and miscellaneous lighting service, when the demand arising from the lighting service does not exceed 20 per cent of the total simultaneous demand for the combined service.

The order provides also that the maximum rate of charge for electric lighting service under any one month shall not exceed the following: First 200 kw-hr., 10 cents per kw-hr.; next 200 kw-hr., 8 cents per kw-hr.; next 200 kw-hr., 6 cents per kw-hr.; all over 600 kw-hr., 4 cents per kw-hr.

Service specified as "power" may be contracted for at the option of the consumer at the following monthly rates: First 200 kw-hr., 6 cents per kw-hr.; next 200 kw-hr., 5 cents per kw-hr.; next 200 kw-hr., 4 cents per kw-hr.; all over 600 kw-hr., 3 cents per kw-hr.

The above schedules will cause reductions in the rates of the Milwaukee Electric Railway & Light Company, the Commonwealth Power Company and the Plankinton Electric Light & Power Company, but the commission stated that these schedules will not result in lower earnings than the companies are entitled to receive.

In addition to the above schedules, the commission has fixed rates for installation and for combined light and power service; determined what shall be the assessed and what the measured demand; classified rates for breakdown service, discounts, etc. In regard to the sale of fixtures, the order provides that the company may sell appliances, fixtures and equipment at not less than the cost price thereof, including interest at 6 per cent. It may also lease such appliances or fixtures at rentals which amount to not less than the sum of the ordinary repairs, if borne by the company, and the depreciation and interest charges thereon.

MASSACHUSETTS COMMISSION.

The Gas and Electric Light Commission will give a public hearing at its offices in Boston on Sept. 19 upon the codification of laws relating to the manufacture, transmission, distribution and sale of gas and electricity, exclusive of street-railway, telephone and telegraph service, as required by act of the last Legislature. The board will give special attention to discrepancies in the existing laws and to suggestions for amendments, and will report to the next Legislature any changes which may appear advisable.

The commission has approved the purchase by the Edison Electric Illuminating Company of Boston of the Hyde Park Electric Light Company and the Weston Electric Light Company, both of which serve communities about 10 miles from Boston. The maximum net price will be reduced from 13.5 cents to 10 cents per kw-hr. as a result of the consolidation. The board further stated that the recent consolidation of Hyde Park with the city of Boston renders a common Edison service desirable in both localities. In the Weston case the town authorities contended that the merger should not be permitted if the result would be an increase in the rate for street lighting.

The board pointed out that the question of street lighting is not before it, but that ample authority exists for the adjudication of such an issue if it arises later. The highest net rate for commercial lighting will drop from 15 to 10 cents per kw-hr. as a result of the merger.

The board has reduced the price of gas in the town of Plymuoth to $1.65, following the conclusion of hearings brought by petitioners for a lower rate on the system of the Plymouth Gas Light Company.

MICHIGAN COMMISSION.

Application has been made to the Railroad Commission for authority to merge the Home Telephone Company of Washtenaw County with the Michigan State Telephone Company. The Home Telephone Company operates plants in Ann Arbor, Ypsilanti and Dexter, where the Michigan State also operates exchanges.

# Current News and Notes

Concentration in East Tennessee.—The East Tennessee Power Company, which owns large hydroelectric plants, recently purchased several small public-utility plants in its territory. It is subsidiary to the Tennessee Railway, Light & Power Company.

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Byllesby Luncheon Club.—The recently organized Byllesby Luncheon Club of Chicago has elected a new managing committee consisting of Messrs. James E. Hewes, W. F. Stevens, Jr., and W. H. Hodge. Mr. H. V. Coffy was re-elected secretary.

* * *

Appraisal of Elmira Electrical Properties.—The properties of the Elmira Water, Light & Railway Company, Elmira, N. Y., were recently appraised by Mr. Henry Floy, consulting engineer, author of "Valuation of Public Utility Properties." The company attempted to collect an overdue account and the customer set up the claim of unfair charges considered on the basis of a fair return upon the value of the property employed in the service rendered. The court requested the attorneys to submit briefs, so that a decision will not be rendered until autumn.

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"Made in Chicago."—During the recent "Made in Chicago" week the Chicago Telephone Company introduced a variation by advertising that 1,696,589 telephone calls are made in Chicago every day. The company also asserted that by its recent growth it has become the greatest consumer of the telephonic manufactures of the Western Electric Company. It was declared that about fifty freight cars daily would be required to transport the entire output of the Western Electric Company, made in Chicago. The Chicago Telephone Company had 290,588 telephones installed in the city on Aug. 14.

BETHLEHEM STEEL WORKS TO INSTALL ELECTRIC FURNACE.—A 10-ton grid electric furnace to be used for making special steels is to be installed by the Bethlehem Steel Company. This furnace is used to some extent in Germany.

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TRANSMISSION OF TIME SIGNALS BY WIRELESS TELEGRAPHY.—It is stated that upon the completion of the government wireless towers at Arlington, Va., wireless time signals will be sent out daily. The details of the plant, it is said, are not yet completely worked out.

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KEYLESS FIRE-ALARM BOXES.—The city electrician of Chicago has been directed by the City Council to advertise for bids for the changing of all fire-alarm boxes in the city provided with keys to keyless glass-front boxes. The change will affect about 1500 fire-alarm boxes.

* * *

HYDROELECTRIC PLANTS NOT DAMAGED BY STORM.—Late reports from the Indiana & Michigan Electric Company, of South Bend, Ind., in relation to the reported damage to the hydroelectric plants of that company in Berrien County, Mich., by high water following the storm of Aug. 17 and 18, are to the effect that the reports were erroneous, as the storm did no damage to the plants of the company named.

* * *

ELECTRIC VEHICLE ADVERTISING.—The Commonwealth Edison Company of Chicago has entered into contract for the rental of thirty illuminated display signs in Chicago to be devoted exclusively to electric-vehicle advertising for several months. These signs are located conspicuously in various parts of the city and will bring the advantages of the electric vehicle forcefully to the attention of the public.

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FIRE IN LONDON TELEGRAPH OFFICE.—On Aug. 24 a fire started about 7 p. m. in the General Post Office at London, England, and it is reported that for three hours all telegraphic communication with the outside world was interrupted. The following day was Sunday, which, owing to the light traffic, facilitated the restoration of service. The telegraph system of England is owned and operated by the government.

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FOREIGN TARIFFS.—Issue No. 7 of *Foreign Tariff Notes*, prepared by the Department of Commerce and Labor, has recently been published. It is announced that hereafter the *Foreign Tariff Notes* will appear quarterly, with an annual index. The present issue contains an index of the first seven numbers, arranged alphabetically by countries. These notes relate to the tariff provisions of the foreign countries of the world.

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FOUR-HUNDRED-FOOT WIRELESS TOWER COMPLETED AT SAYVILLE, N. Y.—The Atlantic Communication Company recently completed a 400-ft. wireless tower at Sayville, N. Y., for use in radio-communication with the vessels of the Hamburg-American and North German Lloyd Lines. The Telefunken wireless system is employed. It is reported that communication will be established later across the Atlantic with Germany.

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THE WHY OF ELECTRICITY.—In a recent issue of a Washington (D. C.) paper appeared the following enlightening discussion of the operation of gas-engine ignition apparatus: "'Many motorists do not understand the difference between a magneto and a dynamo,' said an electrician yesterday. 'In a magneto the electricity is generated by the action of the magneto, while in the dynamo the electricity is produced by conversion of a high degree of mechanical energy.'"

* * *

CAMPAIGN FOR TELEPHONE CONSOLIDATION IN LOS ANGELES, CAL.—The recently organized Te'ephone Reform Association, Los Angeles, Cal., has just inaugurated a local campaign against the dual telephone system. In a set of resolutions adopted by the association it is set forth that the experience in Los Angeles with two telephone systems shows that they are less satisfactory and less economical than a single system. About 140,000 letters containing copies of the resolution have been mailed to local subscribers.

* * *

CURB LIGHTING IN DES MOINES.—Des Moines, Ia., has an elaborate system of curb lighting, and some of the merchants have started an agitation to have the city assume the expense of operating this lighting system, which so far has been borne by the merchants, each post with five 100-watt lamps being charged for at the rate of $5.80 per month. The city has been asked to discontinue the arc lamps at street intersections, which burn from midnight to dawn, and in place of these to assume the expense of the all-night lighting of the top lamp in the five-lamp cluster.

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COOSA RIVER DAM BILL VETOED.—Before the adjournment of Congress this week President Taft vetoed the bill relating to the Coosa River Dam project. This bill would have authorized the construction of a dam across the Coosa River in Alabama without provision for reimbursement of the federal government. The President based his disapproval upon the principle that the government in granting water-power rights should receive compensation. Secretary Stimson has consistently urged the adoption of the policy that a grant of water-power privileges is one for which the government is entitled to proper compensation.

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WATER-POWER SITES ON GREEN RIVER, WYOMING.—The waters of the Green River, the main branch of the Colorado, and its tributaries, while possessing large possibilities for the development of power, are practically unused except for irrigation. Theoretically it would be possible at the present time, according to the United States Geological Survey, by utilizing know storage sites, to develop about 1,500,000 hp in the basin of the Green. From Wells, Wyo., to the Wyoming State line, a distance of 225 miles, the stream has an average fall of 11 ft. to the mile, and from the Wyoming State line to the mouth of Minnie Maud Creek, a distance of 200 miles, the average fall is 7 ft. to the mile. The total fall is 3875 ft.

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LOUISVILLE & NASHVILLE RAILROAD TO BUILD TELEGRAPH LINES.—The Louisville & Nashville Railroad Company and the Western Union Telegraph Company have failed to renew a contract for the exchange of service which expired Aug. 17, and the railroad company is now preparing to build and operate its own telegraph system. It is reported that telephonic train dispatching will be substituted to some extent for the telegraph. The Western Union company is endeavoring, by condemnation proceedings, to continue the use of the railroad right-of-way for its poles and wires, which the railroad company is opposing. The railroad company has served notice that the telegraph poles and wires must be removed from its right-of-way by December.

* * *

OPPORTUNITIES FOR THE TECHNICAL GRADUATE.—The June issue of the *Bulletin* of the Throop Polytechnic Institute, Pasadena, Cal., contains an interesting analysis of the opportunities for technical graduates in southern California, written by Prof. George A. Damon, dean of the institute. Included are the answers to three questions which were asked of more than seventy technical men of southern California. The first question was, "What do you think of a technical college education?" The second was, "What is the best way to get practical experience?" The third was, "If you were a young man starting all over again at the present time what would you do?" In the opinion of those asked electrical engineering stood higher than any other engineering profession in opportunities.

Knapsack Wireless Kits.—One of the latest developments in radio-communication is a complete wireless installation which can be carried in the knapsacks of four men, as adopted by the British army. The portable tubular mast is about 30 ft. in height and is made chiefly of aluminum to reduce its weight. The knapsack stations have a range of about 10 miles.

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Extension of Long Island Railroad Electrification.—It is announced that electric trains will commence running on the Whitestone branch of the north side division of the Long Island Railroad when the winter time-table takes effect on Oct. 22. This date is tentative to the extent that it depends on no unforeseen interruptions to the work. Grade revision of the Port Washington line, preliminary to the work of electrification, is in progress.

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"Writ Sarkastic."—In commenting on the announcement that the New York, New Haven & Hartford Railroad Company has decided to "electrify" its main line between Boston and Providence, the *Chicago Tribune* gave expression to its consternation in the following terms: "Someone stop this misguided railroad corporation before it is too late. Electrification is not possible. If it were possible, such a public-spirited, public-serving corporation as the Illinois Central would electrify. We know it is not possible. The Illinois Central says so in season and out of season, and the only reason it scatters cinders and spouts smoke up and down the south shore is because it cannot use electricity."

* * *

City Planning Congress at Düsseldorf, Germany.—Düsseldorf, the most beautiful and modern city in western Germany, known as the "Park City," and the center of the industrial empire, with its extraordinary commercial and political developments, is at present holding an exhibition on city planning, city operation and city administrative functions. The exhibition will be open to the public until Oct. 31, while the International Congress adjourned its sessions on Sept. 28. The first group of exhibitions consists of general ground plans, traffic systems, such as railways, local and express facilities, elevated, subway, suspension and street railways, aviation stations, city embellishment, bridges, docks, parks, lawns, forests and real estate politics. Under "city operation" are grouped gas works, water works, electric central stations, sewage systems, street cleaning, refuse disposal, cemeteries and crematories. Under the third group, "administrative functions," are exhibited plans and models of hospitals, rescue homes, poorhouses, lodging houses, orphan asylums, homes for widows and the aged and infirm, schools, churches, museums, art galleries, libraries, concert halls, etc. It will be noted from the foregoing that this exhibition is planned with the well-known German thoroughness so that hardly any subject is omitted that is of importance in city planning, city operation and administration.

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## SOCIETY MEETINGS.

Iowa Railway Convention.—The Iowa Street and Interurban Railway Association will meet at Waterloo, Ia., for its next annual gathering in April, 1913. Mr. H. E. Weeks, Davenport, Ia., is its secretary.

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Indiana Association Convention.—On Oct. 16 and 17 the Indiana Electric Light Association will hold its annual convention at Indianapolis. The secretary of the association is Mr. J. V. Zartman, 120 South Meridian Street, Indianapolis, Ind.

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Ohio Engineers' Convention.—On Nov. 21 and 22 the Ohio Society of Mechanical, Electrical and Steam Engineers, of which Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio, is secretary, will hold its annual convention at Akron.

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Telephone Pioneers.—The second annual convention and reunion of the Association of Telephone Pioneers of America will be held in New York City on Nov. 14 and 15. Mr. Henry W. Pope, 15 Dey St., New York City, is secretary and treasurer.

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Convention of Vehicle Association.—The Electric Vehicle Association of American will convene for its annual meeting in Boston on Oct. 8 and 9. Mr. Harvey Robinson, 124 West Forty-second Street, New York, is the assistant secretary of the association.

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Meeting of Railway Association.—The Central Electric Railway Association held its regular meeting at the Oliver Hotel, South Bend, Ind., on Aug. 29 and 30. The mornings were devoted to the transaction of business and the afternoons to pleasure trips.

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Alabama Electric Association Convention.—The Alabama Light & Traction Association will hold its annual convention at Birmingham in November on a date not yet selected. Mr. George S. Emery, 11 North Royal Street, Mobile, Ala., is the secretary of the association.

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Railway Electrical Engineers.—The 1912 convention of the Association of Railway Electrical Engineers will be held in Chicago from Oct. 21 to 26, with headquarters at the Auditorium Hotel. Mr. Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill., is the secretary of the association.

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American Physical Society.—The annual meeting of the American Physical Society, of which Mr. Ernest Merritt, Cornell University, Ithaca, N. Y., is secretary, will be held in connection with the American Association for the Advancement of Science at Cleveland, Ohio, during the latter part of December, 1912.

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Electrical Contractors' Association of New York State.—Jan. 21, 1913, has been selected as the date for the annual meeting of the Electrical Contractors' Association of New York State, which is to convene at Syracuse. Mr. George W. Russell, Jr., 25 West Forty-second Street, New York, is secretary of the association.

* * *

Vermont Electrical Association.—As previously announced in these columns, the Vermont Electrical Association will hold its twelfth annual convention at Rutland, Vt., on Sept. 12 and 13. The following program has been arranged: On the first day an executive session will take place at 2 p. m. During the day automobiles will be provided to convey the guests to points of interest about the city, and at 8 p. m. an illustrated lecture will be given by Mr. L. D. Gibbs. On the second day there will be a clambake at Lake Bomoseen. The secretary of the society is Mr. A. B. Marsden, Manchester, Vt.

* * *

Railway Signal Association.—The sixteenth annual meeting of the Railway Signal Association will be held at the Chateau Frontenac, Quebec, Can., Oct. 8, 9, 10 and 11. It will also be the seventh annual meeting of the Signal Appliance Association, the membership of which consists of the associate members of the Railway Signal Association. Arrangements have been made for a special train from Chicago on Sunday, Oct. 6, and another from New York on Monday, Oct. 7. Morning and afternoon business sessions are planned for Tuesday and Wednesday, Oct. 8 and 9, and a morning session for Thursday, Oct. 10. Friday will be given over to an excursion.

# DEVELOPMENT ON EAST CANADA CREEK.

## Station of the East Creek Electric Light & Power Company at Inghams Mills, N. Y.

### Plant Supplements Older Hydroelectric Station on Same Stream and Operates in Conjunction with Steam Station 30 Miles Away—Steel-Tower, 60,000-Volt Line Connects the Two Generating Systems—Energy Used Chiefly for Railway Service.

THE station of the East Creek Electric Light & Power Company, located on East Canada Creek at Inghams Mills, N. Y., about 5 miles above the junction of the creek with the Mohawk River, supplements an older development owned by the company and located 3½ miles below the new site. The output of the new station is used chiefly by the Fonda, Johnstown & Gloversville Railroad Company. The latter has a 4000-hp steam station at Tribes Hill, and on this account it was not considered necessary to provide much water storage at Inghams Mills, the steam plant being of sufficient size to tide the hydroelectric station over any low-water periods likely to occur.

DAM.

A dam of cyclopean concrete was built at a narrow point in the East Canada Creek channel. It reaches a height of 123 ft. and is 400 ft. wide at the crest. This, however, does not include a spillway, which was built as a separate structure, connecting with the main dam at one end. The spillway is 205 ft. long and its crest is 8½ ft. lower than the top of the dam. It is built at an angle of about 16 deg. to the main dam, and inasmuch as it is located outside of the natural channel limits, a diversion wall was built to direct the flow back into the stream bed.

Two riveted steel pipes, 6 ft. in diameter, pass through the dam at a level of approximately 100 ft. below the crest and are provided with butterfly valves at their lower ends. By this means the reservoir may be drained when necessary and water by-passed to the lower plant. Moreover, these sluice pipes may also be employed in times of severe

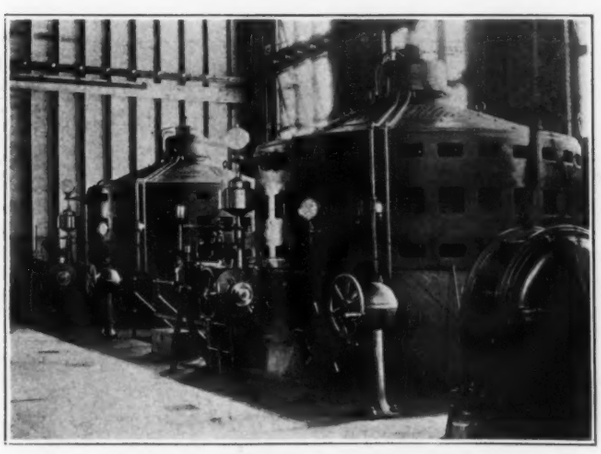


Fig. 1—Generating Equipment of East Creek Electric Light & Power Company.

flood to supplement the spillway, in which case about 15,000 cu. ft. of water per second may be discharged. There are three headgates now in place on the dam, two for the present 9-ft. penstock and one for a 6½-ft. line to be installed later. The racks, which are 27 ft. long and 28 ft. deep, are provided with a floating boom between the piers to ward off débris.

PENSTOCK AND SURGE TANK.

The single 9-ft. pipe line at present installed supplies the two units now in operation. This penstock is 625 ft. long, and at a point 415 ft. from the dam, where the pipe dips down from the crest of the hill, a surge tank is provided. The latter is 20 ft. in diameter and 75 ft. high, and its top

Fig. 2—Dam and Spillway on East Canada Creek.

is 20 ft. above the crest of the dam. It is joined to the pipe line by a 7-ft. connection, which is intended to throttle the flow between the penstock and the tank, and thus to reduce the time of the surge and to allow a smaller diameter standpipe to be used. On the side of the penstock opposite the surge tank a 3½-ft. nipple has been installed for connection to the future penstock. By increasing the height of the tank 8 ft. it is expected that the surges from the additional penstock will be amply provided for. At its lower end the penstock divides into two branches to serve the two units, and on each of these branches, just outside the entrance to the turbine casing, a manually operated butterfly valve has been installed. The exciter turbine is supplied through a 16-in. pipe leading from one of the branches. Near the power house a 9-ft. nipple is provided in the main branch, which will be later connected to the additional pipe line.

The penstock is made of riveted steel with lap joints, the thickness of the steel at the upper end being ⅜ in. and at the lower end ½ in. There are angle stiffeners around the outside of the pipe, spaced about 12 ft. apart for its entire length. The lower end of the line is designed to withstand a pressure 100 per cent greater than the static pressure, in order to guard against water hammer or any sudden stresses resulting from a quick closure of the turbine gates. Two gland expansion joints are provided on either side of the surge tank anchorages, and a vent pipe has been placed just below the intake gate at the dam to permit air to enter the pipes when the headgates are closed.

POWER HOUSE.

The power house is a steel frame structure with brick walls built on concrete foundations, and inasmuch as the tailrace level almost reaches the center line of the turbines

during high water, the outside walls of the foundation are made water-tight and a sump with a small motor-driven centrifugal pump is provided to keep the foundations dry.

The main turbines are vertical-shaft, single-runner Francis wheels, with cast-iron spiral casing and pivoted guide vanes. Each has a rating of 4000 hp under a 115-ft. head when operated at 300 r.p.m. The runners are made of bronze and are 4 ft. in diameter. The governors for each wheel are mounted immediately in front of and on the turbine casing and are supplied with oil under pressure by two motor-driven pumps. The wheels and governors for both the main and the exciter units were manufactured by the Pelton Water Wheel Company, and the guaranteed efficiency of the main wheels at three-quarter load is 84 per cent.

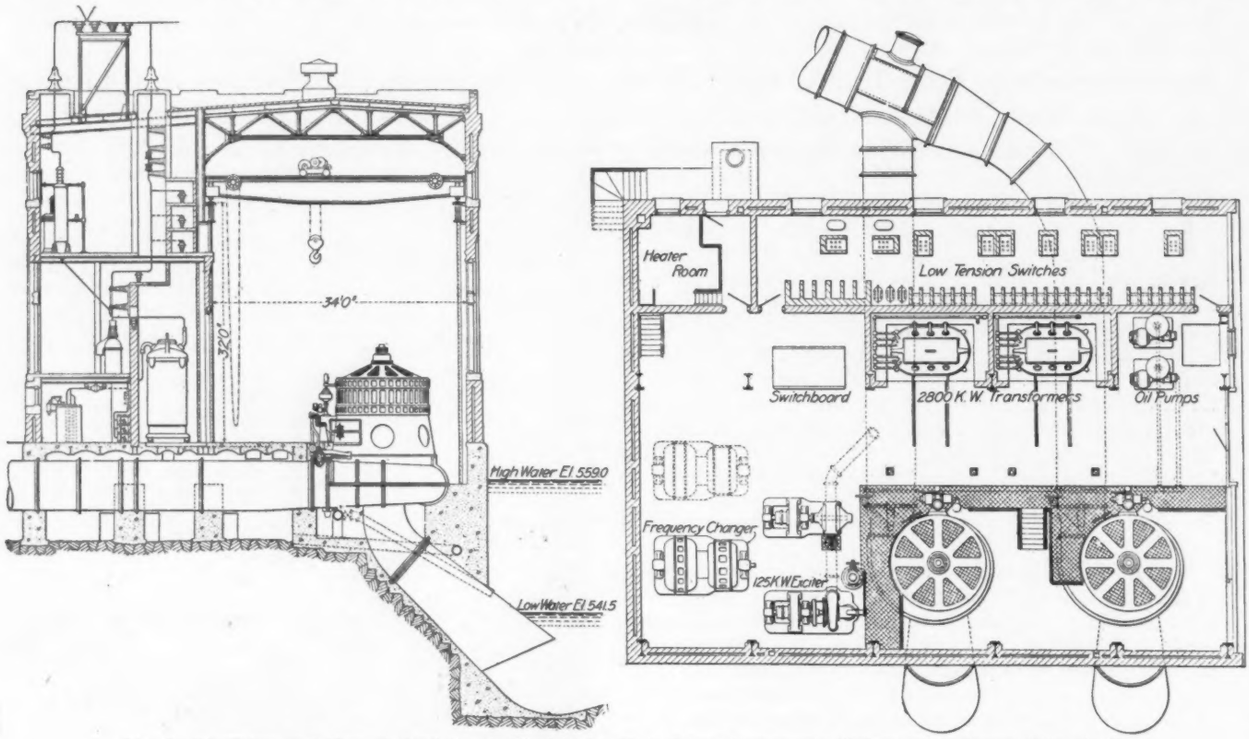



Fig. 3—Elevation and Plan of East Creek Electric Light & Power Company's Station at Inghams Mills, N. Y.

### ELECTRICAL EQUIPMENT.

The generators are rated at 2800 kva, three-phase, 25-cycle, and are wound for 2300 volts. To provide excitation a 200-hp horizontal shaft Francis waterwheel unit is installed, and this is supplemented by a 125-kw exciter set driven by a 200-hp induction motor. Two 2800-kva, three-phase, 25-cycle water-cooled transformers are provided for stepping up the potential from 2300 volts to 30,000 or 60,000 volts. The transformers are mounted on trucks and can be rolled out of their pockets into the generator room under the crane. The barriers, switch compartments, bus-bar chambers, etc., throughout the station are constructed of brick.

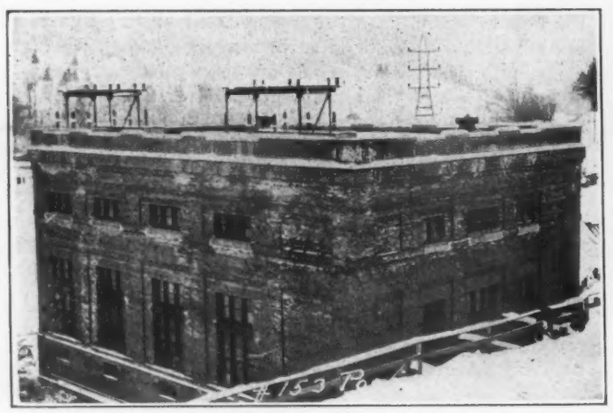


Fig. 4—Transmission Line Leaving Station.

### TRANSMISSION LINE.

There is a 16,000-volt transmission line, 3½ miles long, connecting the old and new hydroelectric developments, and there is also a 30-mile transmission line from the new station to the steam station at Tribes Hill. The latter transmission line is not at present fully loaded, and the transmission voltage is at present 30,000, it being the intention to operate the line ultimately at a pressure of 60,000 volts. Steel towers 60 ft. high, spaced 550 ft. apart, carry a two-

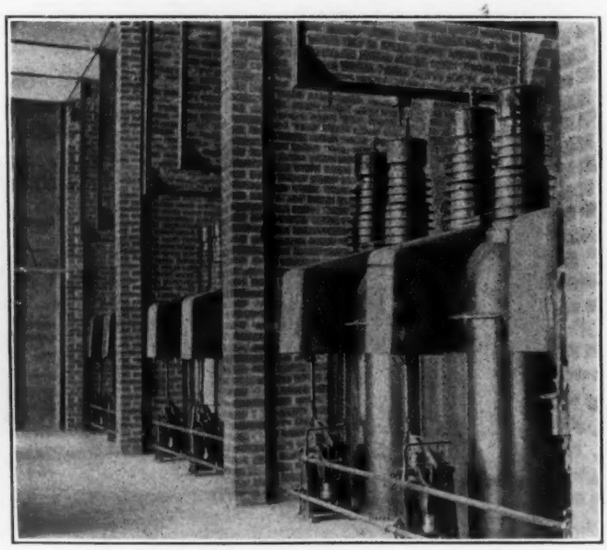


Fig. 5—High-Tension Switches.

circuit, three-phase line arranged in a vertical plane on either side of the tower. The conductors are of No. 2 copper on pin insulators, and a galvanized-steel stranded ground wire is carried along the tops of the towers.

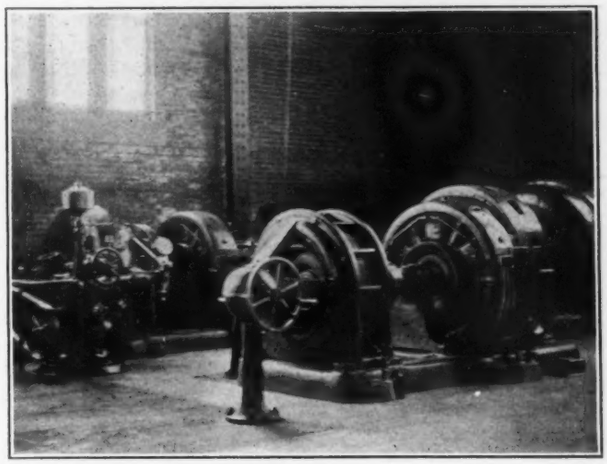


Fig. 6—Exciter Sets in Generating Station.

Inasmuch as the new station is equipped with 25-cycle machines, while the old station still operates at 60 cycles, a 500-kw frequency changer has been installed so that energy may be supplied either to the old station from the new station or vice versa. It was thought advisable to employ the frequency changer until such time as changes in the older station become necessary, for reasons other than frequency uniformity.

The electrical apparatus in the station was supplied by

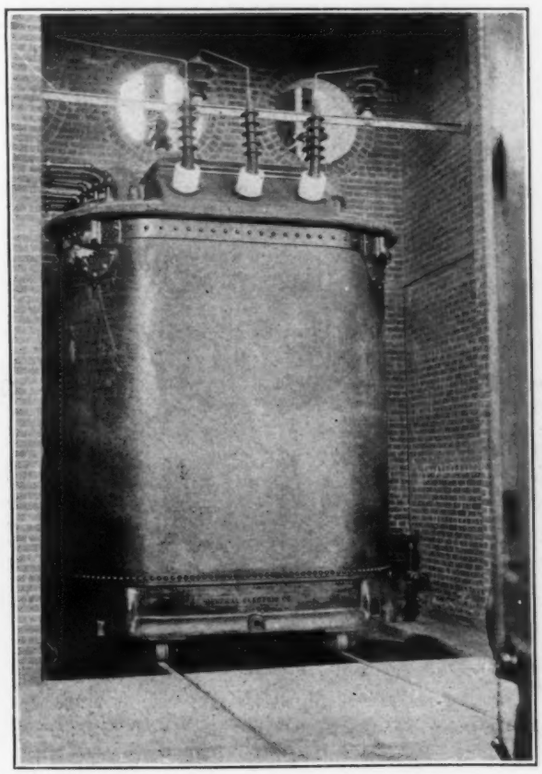


Fig. 7—High-Tension, Three-Phase Transformer.

the General Electric Company, and the entire development was designed and erected under the supervision of Messrs. Vielé, Blackwell & Buck, consulting engineers, New York City.

# USE OF ELECTRICAL ENERGY IN THE MINES OF THE EMPIRE DISTRICT.

## Extensive Motor Drive of Mines and Mills Situated in the Lead and Zinc Districts of Missouri and Kansas.

### Use of 2300-Volt Primary Motors for Underground Pumping Duty—Riverton Turbine Plant and System of Empire District Electric Company, Serving Joplin, Webb City and Carterville, Mo., and Galena, Kan.

MORE than a million dollars' worth of lead and zinc ore is mined and milled each month of the year in the famous Empire District camps centering about Joplin, Webb City and Carterville, Mo., and Galena, Kan. Within half a decade a veritable revolution in the methods of mining and milling this product has been worked by the introduction of central-station service into the field, making economical and efficient motor drive available for the various operations formerly performed by expensive isolated plants.

The system of the Empire District Electric Company, which serves this mining territory, now comprises nine

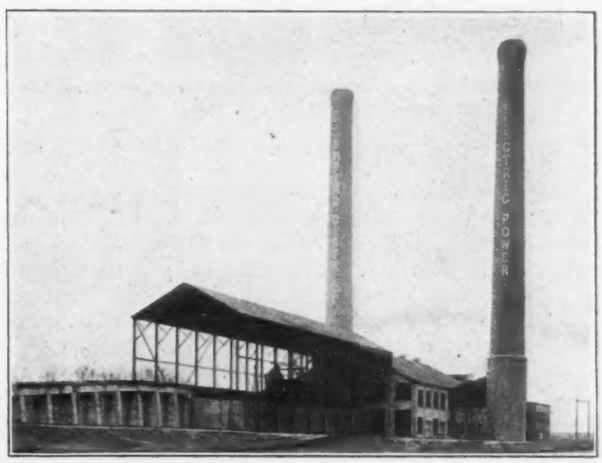


Fig. 1—Under-Water Coal-Storage Pit at Riverton Turbine Station of Empire District Electric Company.

power plants, nineteen substations, more than 100 miles of 33,000-volt, 25-cycle, three-phase transmission lines, and an equal amount of 2300-volt primary distribution. Of the company's nine generating stations, the principal ones are the 20,000-hp steam-turbine plant at Riverton, Kan.; the 3000-hp water-power plant at Lowell, Kan.; a 1000-hp water-power at Grand Falls, Mo.; 1000 hp in steam generating equipment at Joplin, Mo., and a 1000-hp gas-engine station at Webb City. The water-power and Riverton steam-turbine plants are chiefly relied upon for the system output, the other stations, including the gas-engine plant, being reserved as auxiliaries, although when required all of the various generators can be paralleled and the several forms of prime movers operated in perfect unison.

Besides its power service to mines and mills, the Empire District Electric Company supplies the electrical needs of a combined community of 152,000, serving 3500 customers in Joplin, Webb City, Carterville, Galena and other towns on the camp. Its plants also generate the energy to operate 165 miles of modern 500-volt interurban railway connecting these communities.

#### RIVERTON TURBINE STATION.

The Riverton steam-turbine station, 4 miles from Galena, Kan., contains two 7500-kw, 6600-volt, 25-cycle, three-phase Westinghouse alternators, driven at 1500 r.p.m. by Westing-

house-Parsons turbines. Steam is furnished by sixteen 500-hp boilers, under which slack coal is burned. Water sprays over each firing hopper wet down this slack as it is fed onto the grates, the conversion of the moisture into steam, just preceding ignition, acting to break up and prevent the objectionable matting of the fuel which ordinarily interferes with combustion when such slack is fired dry.

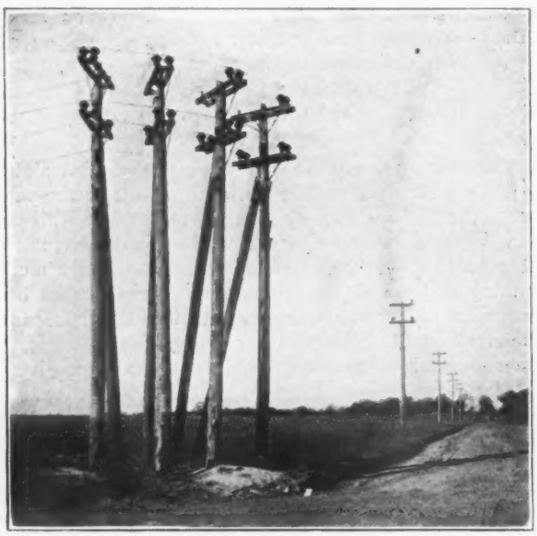


Fig. 2—33,000-Volt Transmission Line, Showing Upper and Lower Ground Wires, Telephone Wires, Etc.

One of the accompanying illustrations gives a good view of the elaborate submerged coal-storage basin adjoining the boiler-room. This massive concrete holder is designed with a capacity for 6000 tons and has a total depth of 26 ft., 10 ft. of which is below the ground level. Loaded coal cars are drawn up the concrete incline by a motor-driven winch, the standard-gage track trestle being supported on piers at the center line of the pit. Spreader sheets beneath the track distribute the coal to the sides of the pit as it is discharged from the drop-bottom cars. The entire basin is built water-tight and is ordinarily kept fully or partially flooded, both as a preventive of spontaneous combustion in the high-sulphur coal and to decrease the heat-unit deterioration of the fuel when stored for any time. Delivery of the coal from the storage pit to the overhead bunkers is effected by telpher hoist buckets, running on I-beam tracks supported by the roof chords. There are three parallel telpher runways over the pit, the two outermost serving to take coal from the piles, while the center one, over the railroad track, enables cars to be unloaded directly into the bunkers if desired. Like the storage pit, the boiler building is of concrete and adjoins the turbine-room, which is of brick. The two brick stacks shown stand 250 ft. above the ground.

Within 200 ft. of the turbine station at Riverton is the old vertical Corliss-engine plant now held for reserve duty. This auxiliary equipment comprises three of the huge Louisiana Purchase Exposition units, which attracted much attention at the fair, and is connected by an underground steam line with the turbine-plant boiler-room. A quarter of a mile below the steam plants is the Lowell water-power plant, whose head-water pond provides the condenser cooling basin for the steam plants.

### TRANSMISSION AND DISTRIBUTION.

Transmission throughout the district is over 33,000-volt, 25-cycle, three-phase circuits carried on pin insulators on wooden poles. Double-arm construction is employed, one phase wire occupying one of the top pins, while the other pin carries a No. 6 galvanized-iron ground wire. Another similar ground wire is carried on a pole bracket just below the second arm, so that all the phase wires are located between two grounded conductors. When first erected this lower ground wire was alone depended upon to protect the transmission circuit, but experience with the severe lightning storms to which this section is subject soon indicated the upper ground wire to be necessary. The lower ground wire is now retained largely for the inductive shielding effect it interposes on the telephone wires occupying a pair of brackets further down the poles. Presence of this lower ground conductor decreases the induction on the telephone circuit to a negligible quantity.

Scattered over the 33,000-volt transmission network are nineteen substations reducing to 2300 volts. For all drives larger than 30 hp in the mines and mills 2300-volt motors are employed, while the small motors, of course, are operated at 220 volts and 440 volts. The use of the primary motors 200 ft. or more underground, amid all the severe conditions of moisture and flooding met there, is one of the most interesting features of this electrification of the Joplin district. Special wood clamps in cast conduit boxes convey the 2300-volt lead-covered cables down the vertical mine shafts, as described in the *Electrical World* of Nov. 14, 1911.

An instructive and valuable paper on power development in this lead and zinc field was presented by Mr. R. A. MacGregor, power agent for the Empire District company, before the Missouri Electrical Association, which met at Joplin not long ago. In preparing this material Mr. MacGregor had the collaboration of Messrs. W. O. Custer, J. G. Horgan, C. B. Rhodes and R. J. Busey, all specialists in his department.

In the Empire District at the present time, said Mr. MacGregor, there are nearly 600 mines in operation, ranging in size from the operator using hand drills and a horse hoister and making his recoveries with hand jigs to such concerns as the American Company and the Orogono Circuit Company, which have in operation numerous shafts and are recovering through complete concentrator plants driven by huge Corliss-engine plants which would make even a central station in a city of 15,000 people look small.

All these mines, however, are not at present fields for

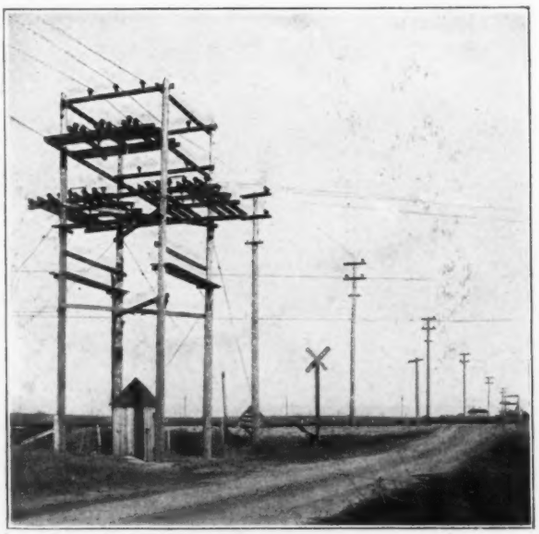


Fig. 3—A Disconnecting Switching Station and Telephone Booth on 33,000-Volt Network.

electric service, for some of them are about worked out and others are hardly making ends meet. In his estimate of the field here for power service the visitor is therefore cautioned not to become over-enthusiastic. Those mines using other power than electricity employ ordinary tubular boilers, slide-valve and simple Corliss engines, gas

engines, steam hoisters and duplex steam pumps. This apparatus is often pretty old, some of it having been bought and sold as second-hand half a dozen times, so that its present money value is not high. Gas is generally used as boiler fuel, being supplemented in cold weather by oil. Such furnace gas costs $0.125 per 1000 cu. ft., while gas-engine gas is purchased at $0.25 per 1000 cu. ft. Coal costs from $1.68 to $2.75 per ton in the bin, according to its size and the proximity of the mine to railroads. While these fuel costs may appear to make brisk competition for electric drives, Mr. MacGregor declares that with the central-station rates offered they are not, after all, hard to beat. The worst obstacle to be overcome is really that of illuminating the total ignorance of most of the operators regarding their present isolated-plant costs. Invariably they want to make a direct comparison between their gas bills and their electricity bills, which, of course, is unfair. A corps of motor-service salesmen is now employed regularly, and at present the power load is increasing at the rate of 1000 hp per month.

The present connected load is about 25,000 hp, and although the rates offered may seem low, there is considerable business paying $100 per kw-year. This milling and pumping load is principally twenty-hour and twenty-four-hour business. The average station load is about 7000 hp, and the peak, which is from 9 a. m. until 3 p. m., runs about 11,000 hp. All energy used for power purposes is sold on a horse-power-hour basis, to avoid, as far as possible, electrical terms and to simplify comparisons of the expense of electric drive.

### ELECTRIC PUMPING.

De-watering, or keeping the mines dry, is often the most serious problem of the mine operator, on account of the quantity to be pumped, or the strongly acid water to be handled. Steam pumps for mine use are very inefficient, since they must be located several hundred feet from the boiler, while their supply pipes are seldom covered and usually leaky, causing heavy condensation. One test on a 4-in. duplex steam pump, handling 200 gal. per minute at 200 ft. head, showed a consumption of 150 lb. of steam per hp-hr., with a combined or over-all efficiency of 20 per cent. With gas at $0.125 per 1000 cu. ft., this gave a fuel cost of 4.8 cents per 1000 gal. pumped, or 8 cents total cost, which is at the rate of 4 cents per 1000 gal. per 100-ft. lift. Another case showed a fuel cost of about 4.5 cents, making the net power cost 6.5 cents per 1000 gal. per 100-ft. lift.

While the combined efficiency of motor-driven centrifugal pumps seldom exceeds 50 per cent, the operation of such pumping service is actually much more satisfactory than

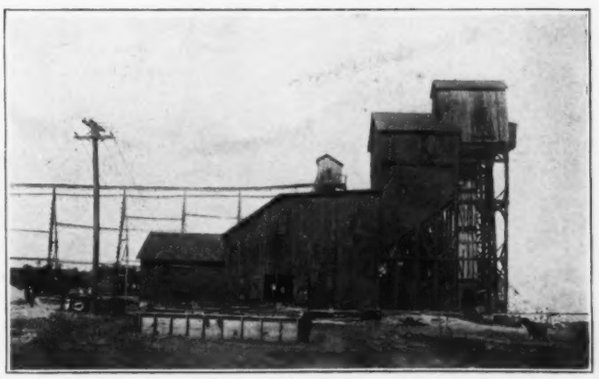


Fig. 4—2300-Volt Service to Typical Zinc Mine in Empire District.

steam, and less expensive. For the above case, for example, a 3-in. two-stage centrifugal pump, direct-connected to a 25-hp motor, was recommended. The load was 20 hp, twenty-four hours per day, thirty days per month, using 14,000 hp-hr. at a cost for energy of $144.74, or a net cost of 8.3 mills per 1000 gal. per 100-ft. lift.

In the entire district there are more than 100 electric pump installations, ranging in size from 20 hp to 100 hp. The water supply of Webb City is pumped by five 25-hp motors direct-connected to deep-well pumps. These units are run only between 4 p. m. and 9 a. m., under a special contract provided to build up the off-peak load.

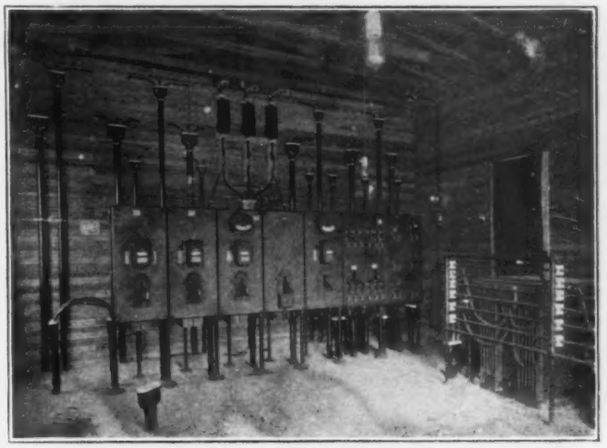


Fig. 5—2300-Volt Entry and Switchboard in Mine Substation.

Acid water in the mines is one of the problems of the Empire field. In some cases bronze-lined pumps have to be used, and even these are eaten up in thirty to ninety days. A local foundry makes a centrifugal pump casing out of wood, with chilled-steel shafts and bronze impellers. The wood casing has a sheet-lead lining, but these pumps have not been entirely satisfactory, as their efficiency is low and their upkeep high. Tests are now being made on a triplex pump lined with a special acid-resisting cement, for which 75 to 80 per cent over-all efficiency is guaranteed, in addition to its handling any acid water for one year.

Another difficult problem is that of pumping the water out of an old mine which has been allowed to fill. For this service two types of pumps are used, one a mine-sinking pump and the other a centrifugal pump with an extended shaft driven from the surface. The sinking pump comprises a 2.5-in., two-stage centrifugal pump, direct-connected to a 35-hp vertical motor, the whole mounted on an iron frame and hung from a cable. The pump can thus be lowered from the top of the shaft as the water is pumped down, and is available for heads from 50 ft. to 250 ft. At the smaller heads it is run as two single-stage pumps in parallel, and at higher heads as a two-stage pump with the stages in series. The pump has a capacity of 200 gal. to 450 gal. per minute at low heads. The other unit has a capacity of 1500 gal. to 2000 gal. per minute, and is a four-stage vertical pump with the driving shaft extending out above the surface of the ground. Around this shaft is a 3-in. pipe with spider bearings every 8 ft. This 3-in. pipe, which is kept full of oil, is surrounded in turn by a 10-in. pipe or column, also centered by spiders, the discharge being between the 10-in. and 3-in. pipes. The efficiency of this pump is from 35 to 45 per cent. It is driven by a 200-hp motor, and is employed to keep mines dry where the inflow is 1000 gal. per minute or more, or where an interruption in service of thirty minutes would be likely to drown the direct-connected motor under ground.

### COMPRESSED-AIR DRILLING.

In the majority of the mines in the Empire region dirt is broken with compressed-air drills. Five sizes of compressors are in use, being locally rated, according to the number of drills they can operate, as three, five, seven, eleven and fourteen-drill machines. The five-drill machine, which is most generally used, is able to compress about 540 cu. ft. of free air per minute, to 80 lb. per sq. in. pressure, and it requires a 75-hp motor for its operation.

The seven-drill or 707-cu. ft. machine takes a 100-hp motor; the eleven-drill or 1056-cu. ft. machine a 150-hp motor, and the fourteen-drill or 1312-cu. ft. machine a 200-hp motor. All of the drills in a given mine are seldom in operation at the same time, since stops have to be made to change steel, to set up machines, clean holes or make adjustments. Since the compressor automatically shuts off or "unloads" when the desired pressure is in the receiver, the usual load-factor is low, not exceeding 25 to 30 per cent figured at actual running time, which is about eight hours per day. All the compressors in the Joplin district are two-stage machines, except those used in the Carthage marble quarries. Such two-stage machines show a saving of 10 to 15 per cent in energy consumption over single-stage machines. In general 3.5-in. machines are used in hard and sheet ground, 2.75-in. drills in soft ground, and 2.25-in. drills in very soft ground.

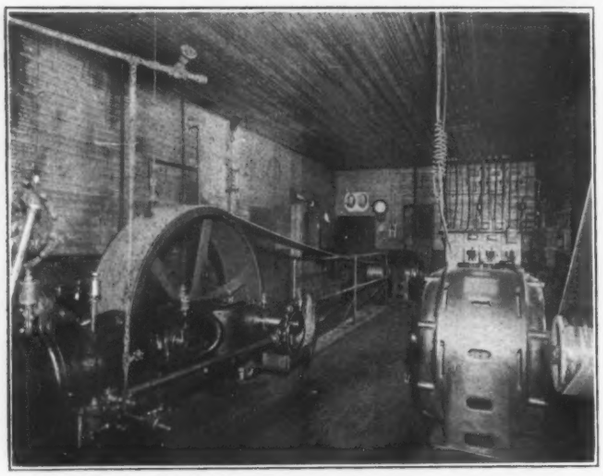


Fig. 6—Motor-Driven Compressor Furnishing Air for Underground Drills.

HOISTING.

The broken "dirt," or ore-bearing rock, is hoisted from the mines in steel buckets commonly called "cans." What is generally known as the "1000-lb. can," 28 in. x 30 in. in size, actually holds about 850 lb. of dirt. Some of the mines use a larger can, 30 in. by 30 in. in size, which holds about 1100 lb. of dirt. A few of the more recent shaft openings have been of a double-compartment type, with self-dumping skips, but the ordinary size of shaft excavated is 5 ft. by 7 ft. Electric-hoist sizes range from 37 hp to 75 hp, with the 52-hp type predominating. These are variable-speed ratings, the constant speed ratings being about 30 per cent lower. The rigging used where electric hoists have displaced steam hoists is quite similar in design to that of the steam equipment, the difference being simply that, instead of an engine, a motor is back-geared on the hoisting drum. These drums are 20 in. in diameter and when greater speed is desired are lagged 2 in. more. The usual rope speed is about 1000 ft. per minute, but the 75-hp outfits develop velocities of 1250 ft. to 1500 ft. per minute, and in some cases speeds as high as 1730 ft. per minute have been used with success.

After being filled with "dirt" at the headings, the cans are wheeled to the bottom of the shaft on individual trucks, which run on 20-lb. rails laid to 22-in. gage. Reaching the shaft, they are hooked to the hoisting cable by the "tub-hooker." From 650 to 700 cans can be hoisted per eight-hour shift. The average height of the hoists is 150 ft., the mean energy used being 1 hp-hr. per ton per 250-ft. lift. The hoisting motor is thus loaded during only about 30 per cent of the actual time consumed in a complete cycle of hoisting operation. As the overload on the motor during actual hoisting is about 50 per cent more than variable-speed rating, it follows that the load factor on a hoist motor is poor, hardly reaching 18 to 30 per cent. For example, a certain 37-hp hoist motor working on an eight-hour basis showed a maximum demand of 60 hp while hoisting. The total energy consumed for the eight hours was 88 hp-hr., giving a load-factor of 18.3 per cent on the eight-hour basis, or 6.1 per cent expressed as a twenty-four-hour load-factor. A 37-hp hoist pulling 7500 tons per month, under average conditions, will cost $90 per month to operate.

The hoisting record for the district was formerly held by a first-motion steam hoist, which raised 1016 1000-lb. cans in one shift, but this record has since been excelled by a 75-hp motor installation, which pulled 1032 1750-lb. cans in a shift. This hoist is now averaging about 1000 cans per shift, and it is only a matter of getting the cans to the shift fast enough for it to pull 1150 or 1200 cans per shift. The record established by the steam hoist followed elaborate preparations for a record run, every man on the job from shoveler to ground boss being worked at top speed. The record of the electric hoists, on the contrary, was made during every-day operation. Where the distance from one face out to the shaft is very long, exceeding 1000 ft. or so, the new practice is to install electric haulage. The cans are wheeled as before to gathering points and there picked up by endless cables, which pull them to the shaft. Such a cable is driven by a 7.5-hp or 10-hp motor and will pull twenty cars at a time.

MILLING.

In the process of "milling" the ore relative density or specific gravity is employed for separating the ore values of lead and zinc from the ground dirt. The dirt as hoisted is first discharged into the mill hopper, from which it is delivered to a jaw crusher and reduced to approximately a 2-in. size. With the aid of water it is then sent through rolls, which again reduce it, this time to ⅜-in. or ½-in. size. After this the finely divided material is elevated and run through a revolving screen, having perforations of from ⅜ in. to ½ in., depending on the character of the dirt. The smaller sizes pass through these perforations in the screen and are delivered into the "rougher jig." Those sizes which will not pass through the screen are returned through the rolls once more, after which they are again elevated to the screen, to be finally delivered into the rougher, the process continuing until all the dirt will pass through the perforations into the rougher jig.

Fig. 7—52-hp Hoisting Outfit in Shaft Tower.

The rougher jig separates the coarser particles of ore from the valueless rock and dirt. Following it the ore passes to the "cleaner jig," which recovers the finer particles of ore not collected in the rougher jig. These jigs are made up of a series of cells having plates about 6 in. below the surface with slots therein, through which all the

finer particles pass. The water in the cells is agitated by shaking, so that the dirt delivered on to the plates is in continual motion, causing the ore particles of high specific gravity to settle to the bottom, while the lighter particles of rock and dirt pass out. In some cases these tailings are taken to a "sand" jig similar in principle to the others, but so constructed as to collect the finer particles of ore that may be washed over.

The water coming from the jigs is diverted into "sludge tanks." In these the heavier ore matters and sands settle out, while the water flows on into the millpond. The ore-bearing sands are then taken from the tank, elevated and run on to flat tables which are agitated horizontally. The heavier ore matter collects at the top of the tables, while the lighter particles of waste dirt and rock are carried off at the bottom on to the tailing pile. The water for the mill is used over and over again, being returned to the same pond from which the mill pumps take their supply.

In separating the ore from the ground dirt steady agitation is required in order to make the ore recovered as clean and free from foreign or waste matter as possible. Zinc ore is sold on a basis of 60 per cent metallic content, and the clean production obtained with motor-driven mills will, in many cases, give products which upon assay contain an excess above 60 per cent. In such instances a bonus of $1

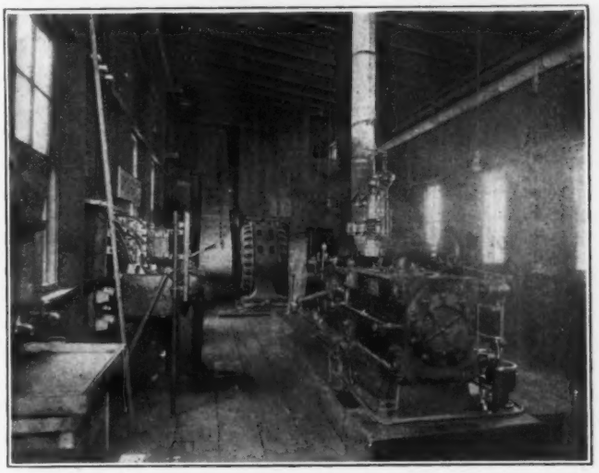


Fig. 8—200-hp, 2300-Volt Motor Which Replaced Corliss-Engine-Driven Mill.

for each point assayed above 60 per cent is added to the base price upon which the ore is sold.

In figuring an electric installation in a mill it is customary to allow 1 hp for each 2 tons capacity which the operator expects to handle through his mill in a ten-hour shift. Ordinarily a single "bull" motor is used to drive the entire mill, including pumps, jigs, etc., but since it is preferable to have water on the jigs before setting them in motion, it may be advisable to run the mill pump by a separate motor. In this way the beds of the jigs are not disturbed by being agitated out of water. The sludge department should also be separately driven in order that this dirt may be run independently of the rest of the mill. Ordinarily the recovery from the sludge department will equal nearly 10 per cent of the total output. Most often agitating tables require about 1.5 hp each. To remove the waste rock a tailing elevator must be added. Such elevators require about 8 hp. Six cents per ton of dirt milled is a fair estimate of mill operating cost. With electric power the grade of ore is improved over that obtained with other forms of drives, while the ore values in the tailing pile are reduced to from 0.50 to 0.75 per cent.

Mr. Henry L. Doherty is president of the Empire District Electric Company, and Mr. George E. Hayler is general superintendent.

## ELECTRICAL APPARATUS FOR MEASURING POWER.

### Description of Direct-Reading Dynamometer Indicating Torque, Speed and Horse-Power of Revolving Mechanisms Without Calculations.

By CHARLES R. MOORE.

THE determination of the amount of mechanical power delivered or transmitted by revolving mechanisms requires the accurate measurement of two quantities, torque and speed. In English units the torque may be defined as the product of the pull in pounds and the radius in feet at which this pull acts. When measured thus the torque is expressed in pound-feet. The speed is measured in revolutions per minute. In making power tests it is obviously essential that the readings of speed and torque be made simultaneously.

When these two quantities are known the horse-power acting may be calculated from the equation $Hp = KTN$, where $T$ = torque, $N$ = speed, and $K$ = a constant.

Two forms of apparatus for making these measurements are in general use, known as transmission and absorption dynamometers respectively. Both types are, however, torque-measuring devices only, since the speed reading is taken independently and does not constitute an inherent function of the apparatus.

Torque may be measured by either mechanical or electrical means. The Emerson machine is a common type of mechanical transmission dynamometer, in which use is made of an epicyclical gear train which causes a lifting moment when power is transmitted. The Goss dynamometer is also mechanical in its action, but belts instead of gears are used. The belts are carried by pulleys supported in a frame, the general arrangement being such that when power is transmitted a lifting moment is produced and may be measured. The chief objection to these two dynamometers is the friction in the gears or belts in the apparatus itself—a large and uncertain factor.

The Van Winkle and Flather dynamometers are of the transmission type and very much alike. Two wheels or disks are mounted side by side on separate shafts having a common axis. In the Van Winkle machine these two wheels are connected mechanically by a spring in such a way that one wheel may turn the other. The movement of one wheel relative to the other is a measure of the torque and is indicated by mechanical means. In the Flather machine one of the two wheels is fitted with a cylinder and the other with a piston set tangentially in such a way that it may move slightly within the cylinder. The space behind the piston is filled with oil, and a small pipe leads down to the shaft, which is made hollow. At the end of this hollow shaft is fitted an indicator, consisting of cylinder, spring and piston, which gives a record of the torque. In these two machines friction is largely eliminated but both are more or less complicated. In the Van Winkle machine centrifugal action on the springs has an appreciable effect.

The Goldsborough dynamometer overcomes largely the ill effects noted above by placing the transmitting spring directly on the shafts and measuring the angle of twist electrically. A disk is placed at each end of the driving spring and arranged to revolve therewith. Each of these disks carries a contact point which comes under a brush pressing on the disk once each revolution. One brush arm may be revolved about the shaft axis and carries a pointer working over a scale divided into degrees of arc. Battery and telephone receiver are connected in series with the brushes. By adjusting the movable brush arm until a click is heard in the receiver, first for zero load and then for any transmitted load, the angle of twist caused by the turning moment may be determined. From the calibration curve of the spring the torque can be read. This device is simple and

easily operated but lacks a visual indication of the torsional moment. This lack impairs its usefulness on fluctuating loads.

The absorption dynamometer may also be of the mechanical or electrical type. The Prony brake, Alden brake, etc., are examples of mechanical dynamometers which absorb all the power supplied to them and at the same time

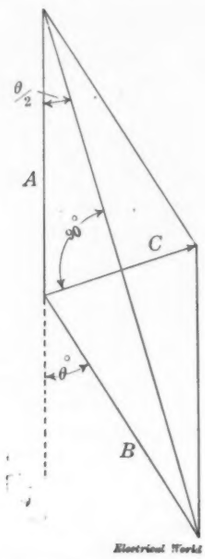



Fig. 1—Vector Diagram, Illustrating Theory of Dynamometer.

give a measure of the torque acting. An electrical absorption dynamometer that has been considerably used consists of an electrical generator mounted in a frame in such a way that as the generator is loaded the frame is swung from its central position. The angle of movement affords a measure of the torque acting. The resisting force is the weight of the generator and frame, and the power developed in the armature is absorbed usually in dead resistances, although sometimes this power is put to useful purposes. In the latter case the apparatus is to a certain extent a transmission dynamometer.

In all the types of apparatus above described the speed must be kept constant at a known value while readings are taken. Calculations are then made to arrive at the power transmitted or absorbed. They all fall short of the ideal dynamometer when the load is fluctuating in that it may not be possible to determine the speed accurately and because of the large number of calculations necessary. Furthermore they do not afford a means for measuring speed, separate apparatus being necessary for this purpose.

With these objections in mind the writer assigned to himself the task a few years ago of developing a direct-reading power meter which would not only give indications of speed and torque but also show directly the horse-power passing through it, no calculations whatever being necessary. The results of the preliminary experiments have been so satisfactory that the machine (with tests) is herein described. So far as the writer is aware this machine is the first successful power meter built.

### THEORY OF DIRECT-READING DYNAMOMETER.

If two sine waves having equal amplitude and frequency be combined algebraically, the resultant curve is also sinusoidal in shape. The amplitude of this resultant curve is a function of both the amplitude and phase displacement of the original curves, and its frequency will be the same as that of the two curves of which it is composed. This may be shown vectorially, as in Fig. 1, in which $A$ and $B$ represent equal maximum values of two sine curves differing in time-phase (measured from point of direct opposition) by $\theta$ deg. Vector $C$ is the maximum value of the resultant curve. From this diagram it is clear that if $A$ remains equal to $B$ but both change in value a given percentage, vector $C$ will be changed by the same percentage.

If the angle $\theta$ varies, vector $C$ will also vary but not in the same proportion. From Fig. 1 it is clear that $C = 2A \sin \frac{\theta}{2}$; that is, $C$ varies proportionally to the sine of half the angle of displacement. For small values of $\theta$ values of $C$ may be taken proportional to the angle, since for small angles the sine and the angle differ by a negligible amount. For mathematical work the sine function of angles up to 3 deg. or 4 deg. is taken proportional to the angle, but for engineering calculations this range may be increased to 8 deg. or 10 deg., or in many cases more, without introducing appreciable error. From the equation shown above, the value of $C$ varies as the sine of half the angle of phase displacement, so that in the apparatus herein described angles of twist up to 25 deg. or 30 deg. may be used with no appreciable deviation from the straight-line law resulting.

THEORETICAL ERROR IN POWER METER UNDER ASSUMED CONDITION.

| Angle of Twist. | θ/2. | Sine θ/2. | Value Based on Straight-Line Law. | Per Cent of Error. |
|---|---|---|---|---|
| 10 | 5 | 0.087156 | 0.087270 | 0.1307 |
| 15 | 7.5 | 0.130526 | 0.130905 | 0.2900 |
| 20 | 10 | 0.173648 | 0.174540 | 0.5140 |
| 25 | 12.5 | 0.216440 | 0.218175 | 0.7950 |

The accompanying table has been prepared to show the theoretical error involved in the power meter herein described when the straight-line law is assumed to exist between an angle and its sine.

This table shows that the inherent error of the machine is well within errors of observation, instruments, etc. The use of a small angle (which means a stiffer spring) is an advantage rather than otherwise since there is then little danger of the spring being overstressed. Furthermore, experiment shows that better results are obtained with the Goldsborough dynamometer (which uses the same kind of spring) when stiff springs and small angles are used.

From the above it is obvious that the value $C$ may be taken as proportional to the product of the value of $A$ (or $B$) and the angle $\theta$. If now voltage $A$ be produced by one single-phase alternator and voltage $B$ by another, voltage $C$ will result when their circuits are connected in series with a voltmeter. If the two alternators have their shafts set on a common axis and flexibly connected by a spring, any

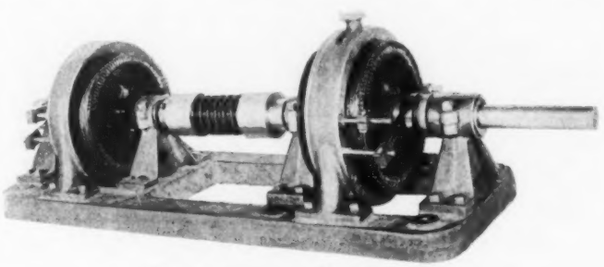


Fig. 2—Dynamometer Assembled.

torque existing between them will change the space-phase and hence the time-phase relationship of their voltages. By adjusting the field (or armature) of one machine these voltages may be made to have a time-phase difference of 180 deg. when no torque exists, and the voltmeter will read zero. If, however, power be applied to the shaft of one alternator and supplied to some mechanism by the shaft

of the other, the voltmeter will read the value $C$, which is proportional to the amount of power being transmitted.

Since both alternators are excited with the same field current, which is constant for all loads and speeds, the voltage developed singly by either generator will be proportional to the speed. The instrument (voltmeter) may therefore be fitted with two scales, horse-power (or watts) and

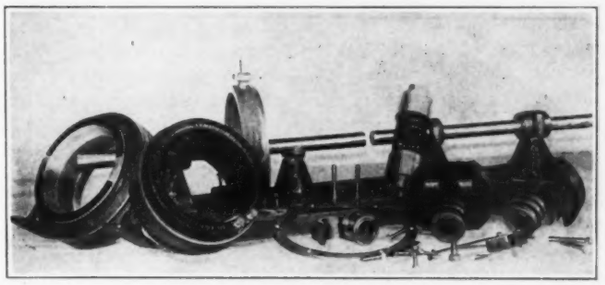


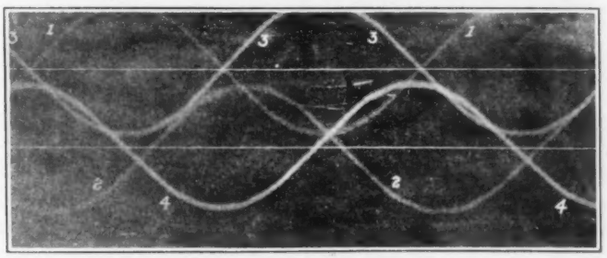
Fig. 3—Dynamometer Disassembled.

speed. By arranging the circuit with a single-pole, double-throw switch readings of speed and power may be made instantly. Visual indications of changes both in speed and transmitted power are possible, and the quantities desired are given without the necessity of referring to curves or tables for the final result.

### CONSTRUCTION OF DYNAMOMETER.

Fig. 2 is an assembly view of the machine showing the general arrangement of parts. Pulleys may be placed on the outer ends of the shafts and the power handled by belts or the meter may be connected between the source of power and the receiving mechanism by means of couplings. A combination of these two schemes is shown in Fig. 6. The driving spring is rigidly fastened to one of the shafts by means of a key and set screw. On the other shaft it is kept from turning by means of a feather key but is allowed to slip endwise freely. This design is made necessary owing to the excessive end thrust on the bearings when both ends of the spring are fastened solidly to the shafts. By using springs of different stiffness the rating of the dynamometer may be varied over a wide range.

The revolving field coils are fastened to the shafts with their polar axes lying in the same plane, so that by reversing the field current in one machine the armature voltages are practically opposite each other in time-phase. Further adjustment, however, is provided for (after the machine is started) by arranging one of the armatures in such a way that it may be turned about the shaft axis. This movement is controlled by the thumb-nut shown at




1 and 2—Stationary Armature.
3 and 4—Movable Armature.

Fig. 4—Oscillograms of Wave-Forms.

the top of the machine on the right (see Fig. 2). This adjustment also affords a means of compensation for the losses in the machine itself. This is a small point, however, since these losses are little more than the friction in two bearings, but there are cases where this compensation of the machine losses is a decided advantage. This movable armature feature may also be used to measure the angle of twist, by keeping the load constant long enough to reset the resultant voltage to zero. The angular movement required will be the angle of torque since the machines are of the bi-polar type. By this means the power meter may be calibrated.

Fig. 3 is a view of the dynamometer unassembled, showing the details of construction. It will be noted that both alternators are bi-polar and the field current is supplied through slip-rings and brushes in the usual manner. These two revolving field windings are connected electrically in series so that both receive the same exciting current. The two generators are so built that equal voltages are obtained for all values of field current. The shafts revolve in phosphor bronze bushings held in cast-iron pedestals as shown in the illustration.

The armature of one alternator is made adjustable about the central axis by mounting the laminations in a ring which fits inside a frame bored out to receive it. This frame is shown in Fig. 3 bolted to the base. A circumferential opening is cut at the top, through which a bolt is screwed into the ring holding the laminations and winding. When adjustment is made this armature is locked securely in place by the thumb nut.

As will be seen in Fig. 3, the armature cores are not slotted, the conductors being laid evenly over about 75 per cent of the armature surface. The winding is of the drum type, supported at the ends by aluminum rings. Two lay-

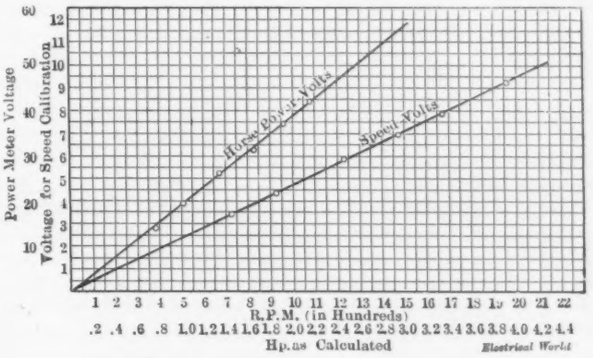



Fig. 5—Test Curves of Speed and Power.

ers of No. 24 double-cotton-covered copper wire constitute the active portion of the winding.

Fig. 4 shows the wave-forms of voltage given by these machines as taken with an oscillograph. Calculations show that they follow the sine law very closely indeed. They are entirely free from any higher harmonics, a feature essential in this apparatus. The curves at the upper part of this film were taken with the machine running light after the voltmeter reading had been adjusted to zero. The lower curves were taken when a torque amounting to about 10 deg. was carried by the machine.

### TESTS.

Test curves of speed and power are shown in Fig. 5. In these tests a constant field current of 4.75 amp was used, the excitation voltage being about 6 volts. As was expected, both curves are straight lines passing through the origin.

In order to separate the measurements of transmitted power from the power meter itself a brake pulley was arranged at one end and the power calculated as in any Prony brake test. Results of this test are shown in the power curve, where readings of resultant voltage as obtained from the power-meter instrument were plotted against the horse-power given by the brake readings. In this test errors incident to Prony brakes entered, but the results were very satisfactory. In these tests the speed was varied from about 800 to 2000 r.p.m. From the curve 1 volt = 0.256 hp.

USES FOR POWER METER.

Fig. 6 shows one of the many uses to which this power meter may be put. The meter is here shown directly coupled to a direct-current generator for measuring friction, windage and core losses. The writer has successfully measured core loss in terms of field current in a finished machine, and experiments leading to the separation of eddy current

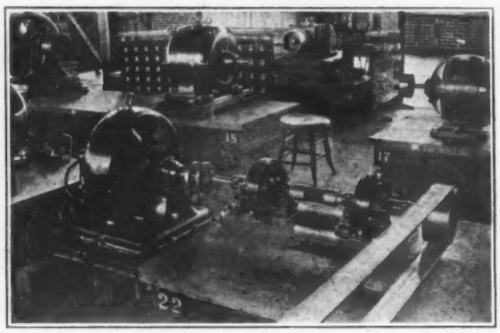


Fig. 6—Application of Dynamometer.

and hysteresis losses in a finished machine are now in progress.

Obviously this meter may also be used to measure losses occurring in belts, gears and all sorts of transmission apparatus. Since its own losses are completely compensated for the machine is capable of indicating these small values accurately. This meter may also be used to measure the efficiency of generators and motors without making use of the laborious processes now in vogue. In practically every case the energy involved can be put to some useful purpose if desired. Gasoline motors, automobiles, etc., may be tested and instantaneous readings of power and speed be obtained directly.

The machine herein described was built, from designs suggested by the writer, as thesis work by Messrs. F. C. Goldsmith and W. Childress, who graduated from the school of electrical engineering at Purdue University, class of 1912, and great credit is due them for their untiring efforts to make the machine a complete success. It is now installed in the electrical laboratories of the university.

## PROPERTIES OF A TRIANGULAR AERIAL.

By Charles A. Culver.

An aerial constructed as indicated in the accompanying diagram would constitute a mechanically stable system and would occupy less land area than several of the other types in common use. These possible mechanical advantages led the writer to investigate the efficiency of such a system as both an absorber and a radiator of electromagnetic waves.

Briefly, the conditions under which the tests were made were as follows. The source of energy consisted of a 25-watt induction coil operated on storage cells and connected to suitable inductance and capacity. A delicate thermoammeter served to indicate resonance between the primary and secondary oscillating circuits. A sheet of tin plate laid upon the grass answered as "earth." As an indicator of the intercepted energy a regular loosely coupled silicon detector with shunted telephone was employed. Wire netting laid upon the grass served as an "earth." The tests were carried out across a part of the Beloit College campus over a distance of 250 m, the soil consisting of coarse gravel covered with grass and trees. The wave-length employed was 285 m.

Referring to the sketch, *AB* and *AD* consisted of No. 12 galvanized-iron wire 5 m each in length. *BD*, though originally intended to be 5 m, measured only 4.5 m. This, as well as all other wires radiating from the common connecting point *C*, was No. 18 copper. The system as a whole was supported in a vertical position, with *BD* 1 m above the ground, and was arranged to rotate about a vertical axis through *AC*.

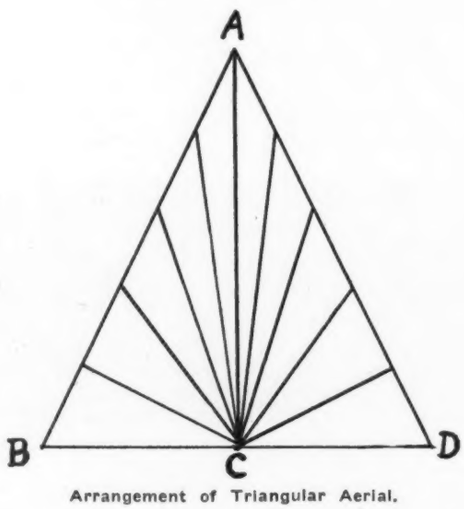
Using two parallel wires 7.2 m long and 34 cm apart as an aerial at the radiating station, readings were made of the intercepted energy as the above-described triangular aerial was rotated about a vertical axis. Repeated measurements showed that the system intercepted approximately 25 per cent more energy when its plane coincided with the line joining the two stations than when it occupied a position at right angles to this direction.

The efficiency of the triangular aerial as a receiving system was compared with that of a simple aerial composed of two vertical wires 62 cm apart and of length equal to *AC* (4.5 m). The triangular type, in its least efficient position, was found to be only 50 per cent as efficient as the two vertical wires just mentioned.

As a radiator the triangular system exhibited different properties from those manifest when functionating as a receiving system. When connected to the oscillator it was found to radiate equally in all planes, and its efficiency was found to be equal to that of the parallel-wire radiating aerial mentioned above (7.2 m).

A change was next made in the construction of the aerial under test. Short porcelain insulators were inserted between the ends of the wires radiating from *C* and the heavier wires *AB* and *AD*, thus eliminating the latter from the electrical system. Upon testing this modified aerial both as a radiating and as a receiving system it was found that it did not differ materially in its properties from the original type just described.

In conclusion it may be said that, though the system tested possesses certain desirable mechanical features, it proves to operate at a comparatively low efficiency, at least when employed as a receiver. Notwithstanding this, however, such an aerial exhibits several interesting properties. The fact that it does not functionate equally well as a radiating and as an absorbing system is not readily accounted for. It is of interest to note that when acting as a radiator its polar curve proves to be a circle, and that as a receptor it does not depart radically from such a curve. In this respect it differs from most rectangular grids or capacity




Arrangement of Triangular Aerial.

areas. This result is probably to be accounted for by the effect of the horizontal components of those elements which depart from the vertical, these components doubtless following Marconi's law for horizontal aerials. The dimensions of the triangle could probably be so modified as to make the polar curve a circle, even when such an aerial acts as a receiving system.

## THE POSSIBILITIES OF TIDAL POWER.

ONE never watches the sweep of the tides without a certain sense of regret at the enormous waste of power recurring daily through the years and a more or less futile attempt to speculate on what might be done to utilize this huge natural source of energy. Unhappily, the tidal head is generally far too low for ready use in the ordinary line of hydraulic practice. Only here and there, as for instance in and about the Bay of Fundy, have the tides a magnitude sufficient to enable one to put them readily to work. And the more one studies the practical problem of utilization the greater the difficulties that appear. The actual body of water raised in a tide is of stupendous potentiality as a producer of power, yet when one begins to compute the really attainable results the low efficiency is discouraging. To start with, even with exceptionally high tidal flow one has to impound a very large area of water to get much power. For a first approximation, assuming the water to be utilized in first-class modern turbines, one can get about 700 hp-hr. per square mile of water stored per foot of fall.

Now, even though the tides may run to an average of 40 ft. or more, as in some parts of the Bay of Fundy and at a few other points on the earth's coast lines, the periodic flow forbids high efficiency, since even under the most favorable circumstances one can only rely on a mean head equal to half the depth of the storage. So about 20 ft. would be the best available head in the case considered, and this would give only about 14,000 hp-hr. per square mile of storage. To get even this amount the power plant must be of a size sufficient to run off the pond in an hour or two, the exact time depending on the rate of tidal flow. This large plant capacity can be diminished only at the cost of losing available head, and at anything like full hydraulic efficiency the operation of the wheels must be confined to two brief periods per day, shifting in regular order through the entire twenty-four hours. Hence in utilizing the power generated there must be such a system of storage as would enable the power output to be distributed through a reasonable working period. Such storage entails a further loss of efficiency if made in any way whatever, a loss amounting to 20 or 25 per cent by most methods of operating. Add to these disabilities the ordinary losses in transmitting power to a point where it can profitably be used and it becomes sufficiently obvious that the net efficiency of the whole series of operations is rather low and the cost relatively high—much higher than first thought would indicate. One can make a rough estimate of possible returns by noting that the square mile of impounded water on a 40-ft. tide would give, with no allowance for storage or transmission losses, a little over 10,000,000 hp-hr. annually, or with these losses included say about 5,000,000 kw-hr. This output would have to bring a rather high price to pay a fair return on any considerable plant investment after the charging off of the necessary operating expenses.

That tidal power nevertheless might be made to pay if worked on a very large scale in a place where topographical conditions favored is still probable, assuming that it did not have to compete with cheap fuel. It is perhaps to be regarded as a resource to be held against the time when fuel becomes scarce, as it must be, with respect to the present distribution of population, within a few generations.

Opinions differ greatly as to the coal supply, yet this much is certain, that the supply conveniently located with respect to the needs of the earth's industries is disappearing very fast. Coal fields on Hudson Bay, in central Africa or along the eastern slope of the Andes will not be of great economic importance until the present nations of the earth are turned topsy-turvy. Perchance this result may eventually follow the fortunes of fuel. But, as things now look, of the natural sources of power coal is certainly by far the most important. Of the rest, the tides, mighty as they are, seem to be economically almost the least important. Direct power from solar heat is far more promising, as it is obtainable for a longer period per day and over a much wider reach of the earth's surface. The earth's arid belt where sunshine is reliable is of vast extent and in a region of great possibilities. One can get a horse-power per 100 sq. ft. of mirror surface for a daily period at least equal to the tidal possibility even with appliances now available, and this implies a far greater power yield per unit of area than can be hoped for from the tides.

If the ordinary hydraulic resources of the world are fully developed it is a question whether the addition of the tidal power capable of fairly economical development is likely to be of any material account. We have as yet made only a bare beginning in impounding rainfall, which is a vastly more economical scheme than the impounding of the tides. A square mile of pond area impounded where it will furnish 800 ft. or 1000 ft. of available head—the more the better—gives a far better chance for cheap power supply than even a very favorably situated tidal basin. For the whole year's rainfall can be stored and utilized, less evaporation, at just such rate as may be required for the varying demands of the community. There are many places in our country in which such all-the-year-round storage is entirely practicable and not at all forbidding in expense. Rain power is just as cheap as tide power to start with and can be obtained at points much better situated with respect to human needs. Here and there a little power can be advantageously obtained from the tides, but on the whole they are merely an imposing fraud, not of serious use for the world's work.

## ELECTRIC FURNACES FOR ZINC REDUCTION.

The feasibility of employing electric furnaces as substitutes for the externally fired retort processes of zinc extraction now used in the Joplin-Galena mineral district of Missouri and Kansas received some attention at the recent convention of the Missouri Electrical Association, held at Joplin. As pointed out in the discussion, the development of such an application would have an excellent effect on the load-factor conditions of water-power plants in the southwestern section of Missouri, where an increasing number of hydroelectric installations are now under construction. Comparing the electric furnace with the retort process for zinc reduction, the following disadvantages of the present externally fired retorts were enumerated:

1 Low thermal efficiency (maximum 6 per cent), using a maximum of 4 tons of coal per ton of ore.

2. Impossibility of controlling the temperature.

3. Losses are large (from 120 lb. to 180 lb. of zinc per ton of ore).

4. Impossibility of using units containing more than 100 lb. of roasted ore.

5. Short life of the clay retort, which is attacked by mineral impurities in the ore.

6. Impossibility of treating low-grade ore.

In contrast the electric furnace presents the following advantages:

1. High thermal efficiency, the heat being communicated directly to the ore to be roasted, and not from the outside through a fire-clay wall.

2. Absolute control of temperature, resulting in a minimum loss of metal.

3. Possibility of using larger units, with longer life and reduced labor charges.

4. Possibility of treating lower grades of ore.

5. Purer and more uniform product.

6. Recovery of lead, copper, silver and gold which the ore may contain.

7. Capital invested per ton of ore is much lower, assuming electric energy can be purchased at from $10 to $18 per hp-year.

# Central Station
## Management, Policies and Commercial Methods

### THE CENTRAL STATION AND GREAT PUBLIC MOVEMENTS.

The story of how the Rochester Railway & Light Company comforts those whose lives are spent in the shadow of suffering and sickness by giving invalids the cooling and refreshing benefit of free electric-fan service is now well known. Another instance of the enthusiasm with which the company seconds any movement of benefit to the citizens of Rochester is shown in the part played by it in the "Field Day" celebration held on Aug. 10. This event was planned by the Rochester Public Health Association for the benefit of a children's free dispensary, and every effort was made to attract the attention of citizens to the crying need of support for this humane work. Complying with Vice-president R. M. Searle's order, the "Field Day" slogan,

"Children healthy, city wealthy—
Started right they'll win the fight,"

was printed on 60,000 of the Rochester Railway & Light Company's gas and electric bills. It was also flashed on all of the company's electric signs, while streamers bearing the same message were carried on all of its trucks and delivery wagons. There is scarcely any great public movement in Rochester with which the Rochester Railway & Light Company does not connect itself, from a sense of obligation as a great public utility, indebted to the people of the city for its life and prosperity. Needless to state, the effect of this interest is reflected in the public good-will toward the utility company.

### CENTRAL-STATION ENERGY FOR RAILROAD SWITCH AND SIGNAL SERVICE.

One of the most recent applications of the electric motor in railroad auxiliary service is in the operation of track switches and signals, a field of interest to the central station on account of the long-hour characteristics of the motor-service demand, or at least its off-peak possibilities. As compared with the old mechanical methods of operating, the electrical system takes up much less space for switch and signal connections, operates more quickly, will handle switches at a greater distance from the tower and is free from trouble with connections in icy and snowy weather. Besides giving an indication of the movement of switches and signals, it requires fewer levermen in the larger installations. Better protection is also secured by the use of electric motors as compared with pneumatic equipment. The size of the installation required in a given area can be decreased, and no trouble is experienced from the freezing of the moisture in air pipes. Although the amount of power required at a given switch or signal is small, frequently not exceeding 1 hp per switch, the practice of operating this class of apparatus by direct current supplied from a storage battery enables the central station to handle the work with convenience and economy.

A representative installation of motor-driven switches and signals is in service at the Allston station of the Boston & Albany Railroad, at the entrance of the Beacon Park freight yard in Boston. In this installation there are twenty-six switch motors and twenty-four signal motors designed for operation on direct current at 110 volts and supplied with energy through leads carried upon and under the roadbed in iron conduit. Energy for motor operation is supplied by a storage battery of fifty-seven cells of 400-amp-hr. rating, housed in a brick building at the side of the track and charged through a mercury-arc rectifier set. The installation is primarily supplied with electrical energy from the regular alternating-current circuits of the Edison Electric Illuminating Company of Boston, and the battery equipment required in the operation of track relays is also charged from this source.

The outside wiring is protected against the worst weather conditions, and the installation has operated with so much reliability that other plants of similar character are now in operation or being placed in service at Boylston Street, Boston; Brookline Junction and Riverside. The Boston Edison company supplies the service in each case.

At Boylston Street thirty switch and twenty-eight signal

Motor-Operated Track Switch.

motors are in service, charging being effected by a motor-generator set. At Riverside, where one of the largest installations thus far made in this territory is just going into service, there are twenty-seven switch and twenty-seven signal motors and a 100-lever electric interlocking machine, the battery being charged by either a motor-generator or a rectifier, as desired. The signals are operated in the upper quadrant, and each high mast is equipped with three arms to produce a uniform arrangement, this scheme being in accordance with the recommendations of the Railway Signal Association. Approach annunciators, signal and track indicators and approach and route electric locking are used.

The use of motors of the same size in all these installations greatly simplifies the maintenance problem. The equipment for the above Boston installations was supplied by the Federal Signal Company, of Albany, N. Y. A feature of the signal lighting at Riverside is the use of incandescent electric lamps instead of oil lamps, which presages a movement that in time may drive the oil lantern from its position in fixed railroad illumination.

### REDUCING COMPLAINTS ON HIGH BILLS.

Of all complaints received by public-utility companies, those on high bills are probably the most difficult to satisfy. It appears to be a well-defined trait of human nature for consumers to look upon bills as representing monthly consumption, rather than that for the number of days between the visits of the meterman, and difficulty arises from the fact that the customer does not notice that the interval between readings may range as high as forty days or more, although the average consumption per diem remains about the same. Hence the increase in the number of complaints when the visits of the meterman do not take place at regular monthly intervals. At the present time complaints on high bills of the Rochester Railway & Light Company are not more numerous than they were five years ago when the company had about one-half the number of gas

and electric meters installed that it has at present. This is attributed in a large measure to the company's policy of advertising its desire that consumers shall learn to read and understand their meters, and at the "information counter," where all complaints are heard, it is stated that most of the customers are now able to read their meters, and that experience shows fewer complaints on high bills to be received from these consumers.

## SELLING ELECTRICITY TO COLLEGES.

In college or university towns one of the interesting problems of the central-station manager is to supply electrical service on a profitable basis to the principal educational institutions, including laboratories, dormitories, lecture and class rooms, libraries, offices and other departments. The field is a comparatively new one for the reason that in the past many such institutions have preferred to maintain their own generating and distributing plants as features of the instruction equipment. The increasing cost of administration has changed the conditions in many cases, so that the college is now to be considered a remarkably good prospective consumer of electrical energy.

It will be found on making surveys of existing college lighting installations that many of these are utterly behind the times. Carbon-filament lamps are in use in many places where high-efficiency units ought to be in service, and in not a few instances old dormitories and lecture halls adhere to open-jet gas equipments which are inexcusable in these days of first-class illuminating engineering. It is doubtful if a better thesis subject could be suggested for electrical engineering students than a lighting survey with recommendations for modern service in all departments. The cost of the change has often deterred the authorities from making it, but it is open to question if many new installations could not be effected without increasing the cost of operation materially, perhaps reducing it in some instances, along with an improvement in service which would increase the efficiency of both students and instructors.

In both lighting and motor-service fields the college offers an excellent diversity factor. The changing schedules and transfers of student interest from one place to another at different hours of the day result in a demand upon the central-station system considerably below the connected load at any one time, and it follows from the service requirements that a relatively small investment in generating plant and transmitting equipment is needed. Even if the lighting load occurs largely during the fall and winter peaks it has the merit of long-hour demands, particularly in dormitories and fraternity houses. Corridor lighting and lavatory illumination are continuous from dusk until the early morning hours, and in the course of a term a large amount of extra service is required in connection with lectures giving evening instruction to the general public as well as to the students. The exterior lighting of yards and walks also demands a long-hour supply of energy, and it is noteworthy that temporary installations of incandescent lamps have lately been used with great success in connection with graduation celebrations, replacing the sputtering and greasy candle in the Japanese lantern and giving a service independent of weather conditions.

As the college is a small world in itself, so its motor-service demands are diverse. In the dining hall and kitchen the operation of fans, pumps, dumb-waiters, elevators, choppers, grinders, polishers, refrigerating apparatus and many other machines offers an attractive field for electricity. Electric cooking of waffles and griddle cakes is entirely practicable on the scale of a university galley and is usually an off-peak load. Electrically driven book lifts are coming into use in the more modern libraries, and it goes without saying that the laboratory, whether medical, chemical, physical or mechanical, is coming to be so dependent upon electrical service that for many researches and experiments it is indispensable. The practice of depending upon the university or college generating plant for the varied service demanded at irregular times by the different departments has no doubt been a means of furnishing engineering students with material for indicator card and fuel tests, but it has often been an expensive policy. The requirements of instruction can be obtained easily enough in other ways, either by testing smaller equipments on the college property or by the investigation of actual service runs in commercial stations outside.

Even a superficial view of this field at once shows the importance of thoroughly investigating it before attempting to make a contract for the entire electrical service of a great educational institution. The problem of dormitory rates is in itself one of some moment. Whether the lighting company shall deal with the student as an independent consumer or serve the building from a master meter and leave the collections to the landlord is a question to be decided locally. It has been found a good plan for the company to read the meters in either case. Sometimes the plan is adopted of measuring energy on the primary side and later deducting for line and core losses as determined by test with the secondary circuits open. The ownership of lines, poles, meters and conduits in college yards is another question to be looked into. The private dormitory injects its peculiarities into the problem, and may be located sufficiently near the college property to take advantage of a common transmission or distribution service. In some cases only the new buildings can be obtained as customers; in others the authorities can better be approached on the basis of a complete study of the conditions. The whole problem offers the central station an interesting situation for treatment along sound engineering lines.

## NEW APPLICATION FOR ELECTRIC IRON.

Specifications for Shaft No. 5, Contract No. 12, of the aqueduct now building between the Catskill Mountains and New York City stipulate that the shaft shall be lined with concrete, followed by a second lining of porous building tile and a third of waterproof felt, with a finishing coat of concrete. In the application of the waterproof felt the contractor, the T. A. Gillespie Company, experienced great difficulty. At first it was planned to use iron hooks with which to fasten the felt to the tile until such time as the inner concrete lining could be applied. This proved to be both a slow and an insecure method. It was then suggested that the felt be held to the tile by means of hot asphalt, but the dangers attending the use of hot asphalt in such close quarters made the plan impracticable. An electric iron was finally procured, and a few experiments proved that the waterproof felt could be heated fast enough to make the use of the iron satisfactory.

Two 8-lb. irons and one 9-lb. iron were purchased for the work, the edges on the working faces of the irons being rounded to a radius of ¼ in., in order to prevent them from cutting into the soft felt. To hasten the adhesion between the tile and the felt a damp sponge was applied to the latter, and an operator with an iron in one hand and a sponge in the other applied the felt to the face of the tiling as quickly as it could be unrolled in front of him. A circuit for feeding the irons was run independently of the lighting circuits of the shaft, so as to avoid complicating the latter circuits. It required no great skill on the part of the workmen to apply the iron, it being necessary to exercise only a little care to put the iron in the right place in order to finish the work with dexterity. The two 8-lb. irons were employed in lining 446 ft. of the shaft, which is 14 ft. in diameter, the 9-lb. iron being held as a reserve for emergency use. The irons are now used for the same purpose in another contract.

## PROMPTNESS IN CONNECTING NEW CUSTOMERS.

The Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., is giving special attention to the quick execution of orders for electric service. Orders taken over the counter in the business office of the company are at once investigated as to the availability of service and the customer's standing with the company. Within a short time they are transmitted by telautograph to the shop, where multiple orders are issued not less frequently than each hour to the meter and distribution departments located near by. In cases where the company does the wiring the first work required of the wiremen is to install the service wiring so that the service loop gang can proceed with their work while the interior wiring is being done. When the wiring is done by contractors the service loop is run without waiting for the building inspector's certificate. In cases where special haste is required and the certificate is already issued, the service loop and the meter are usually installed the same day as the application is signed. When new customers call for rush service by telephone, the company issues instructions from the customer's telephone order and confirms the application at convenience through the mail or by personal visit.

The tabulation shows that the Consolidated company completed a large majority of its orders within two days. The time given for the completion of the order, in case the wiring is done by contractors, dates from the issuance of the building inspector's certificate; if the meter is already on the premises, it dates from the customer's order to reconnect service; in cases where the company installs the wiring and fixtures it dates from the customer's order; in cases of extensions it dates also from the signature of the order, and in the case of discontinuance of service it dates from the receipt of the cut-out order.

PERCENTAGE OF ORDERS COMPLETED WITHIN THREE DAYS.

| | One Day. | Two Days. | Total. | Three Days. | Total. |
|---|---|---|---|---|---|
| November, 1911 | 29 | 35 | 64 | 11 | 75 |
| December, 1911 | 27 | 37 | 64 | 11 | 75 |
| January, 1912 | 32 | 44 | 76 | 10 | 86 |
| February | 35 | 41 | 76 | 10 | 86 |
| March | 61 | 21 | 82 | 7 | 89 |
| April | 61 | 20 | 81 | 8 | 89 |
| May | 59 | 20 | 79 | 8 | 87 |
| June | 58 | 18 | 76 | 7 | 83 |

On Aug. 1 and 2 an analysis was made of the actual time consumed in handling typical orders in the electrical business office in Baltimore. This interval—in twenty-one cases—computed from the exact moment the customer signed the application at the business counter until the line order was handed to the clerk of the distribution department, ready to commence work, was 49.6 minutes, the minimum being 14 minutes and the maximum 128 minutes. During the interval covered by this test the following routine was carried out: (a) The data called for on the back of the application were obtained and written thereon; (b) the salesman referred to the counter cards to determine whether the service was available; (c) the ledger and folio numbers for the customer's account were obtained; (d) the customer's credit and standing were determined by reference to the delinquent ledger; (e) the line order was then transmitted to the shop by telautograph; (f) the multiple order was written in the shop; (g) the multiple orders were assorted for transmission to the different departments, and (h) the multiple orders were delivered to the respective departments.

The August issue of *The Baltimore Gas and Electric News*, published by the Consolidated company, contains a brief comparison of these statistics with the results obtained elsewhere, including Boston, Mass.; Toronto, Ont., and Denver, Col. The dispatch with which the Consolidated company executes customers' orders is noteworthy, as the tabulation shows. In view of the interest which these statistics will have for operating companies it would have been illuminating had the percentages of orders which remain incomplete at the end of five, ten, fifteen, twenty or thirty days been given.

# Wiring and Illumination

## BILLBOARD ADVERTISING IN SAN FRANCISCO.

An example of the particularly effective billboard advertising to be seen at present on some of the fences of San Francisco is shown herewith. It is also indicative of the close relationship maintained by the Pacific Gas & Electric Company with the Electrical Contractors' Association, and

TO LET
DONT SHOW ME ANY MORE OLD HOUSES WITHOUT ELECTRICITY
Phone Pacific Gas & Electric Co.
SUTTER 140
or Electrical Contractors Association
DOUGLAS 2782
FREE ELECTRIC METER AND SERVICE CONNECTION

San Francisco Billboard Advertisement.

it reflects to some extent the competitive conditions existing in San Francisco between the Pacific Gas & Electric Company and the Great Western Power Company. The illustration is apt and fits conditions in many cities having unwired houses. There is much of human interest in the picture of a masculine lady delivering a well-directed blow upon a vulnerable part of the anatomy of a real-estate agent and exclaiming, "Don't show me any more old houses without electricity!"

## CONCRETE VERSUS WOODEN POLES.

The Carnegie Steel Company recently conducted tests on reinforced-concrete poles at its South Sharon (Pa.) plant, for the purpose of determining the relative cost and strength of concrete as compared with wood. The poles tested were 32 ft. long, 10 in. square at the butt and 6 in. square at the top. The corners were beveled, and iron steps bent up ¾ in. were inserted in the forms before the concrete was poured. The mixture employed consisted of one part of Universal Portland cement, two parts of sand passing a ¼-in. screen and four parts of crushed limestone passing a ¾-in. screen but retained on a ¼-in. screen. Each pole required about a barrel of cement, ¼ yd. of sand and ½ yd. of stone. The reinforcement comprised four groups of twisted rods at the corners, placed not less than ¾ in. from the surface. Each group was made up of one ½-in. rod 32 ft. long, two ½-in. rods 24 ft. long and two 3/16-in. rods 16 ft. long. The reinforcement was thus proportioned to the decreasing stress toward the top of the pole. Sheet-steel separators held the reinforcement in place and were cut away to avoid breaking the continuity of the concrete above and below the separator.

The forms used consisted of an upper and a lower section held together by bolts, the lower being a single piece, while

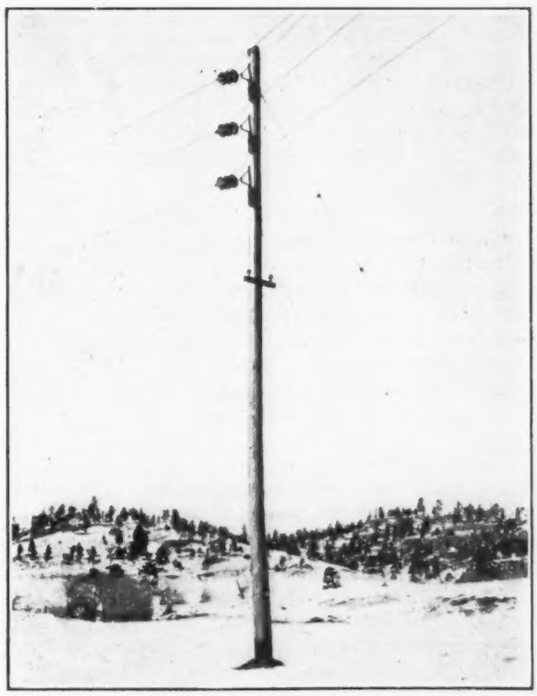
the upper was made up of a series of units beneath which the concrete was forced. The poles weighed about 2500 lb., or approximately five times as much as a wooden pole of the same length.

The tests were conducted with two concrete poles and a 32-ft. chestnut pole under the same conditions. It was found that the wooden pole showed practically the same deflection as the poles of concrete up to 2000 lb., the load being applied at right angles to the pole and at the top. The deformation at 2000 lb. amounted to 25⅝ in., this loading being far greater than could ever be experienced with the poles in actual use. For deflections of less than 15 in. the concrete pole showed no permanent set. A test to destruction was carried out on one of the poles, and failure resulted at the point where the 24-ft. reinforcement rods ended, the concrete being crushed for about 3 ft. above and below the break.

The results obtained showed that the cost of manufacture of such poles should be from $7.50 to $10, as against $4 to $5, the price for a wooden pole. The cost of wooden poles is thus from one-half to two-thirds that of the concrete poles, and their life ranges from a minimum of ten years to a maximum of twenty years, whereas the life of a concrete pole is considered to be practically unlimited. Moreover, the concrete poles require no painting.

## CORNER CONSTRUCTION FOR 50,000-VOLT LINE.

The accompanying illustration shows the unique corner construction developed by the engineers of the Butte Electric & Power Company's system, for use on some of the company's 50,000-volt transmission lines in southern Montana. These angle turns are employed in conjunction with the standard wood-pole line using on tangent stretches two



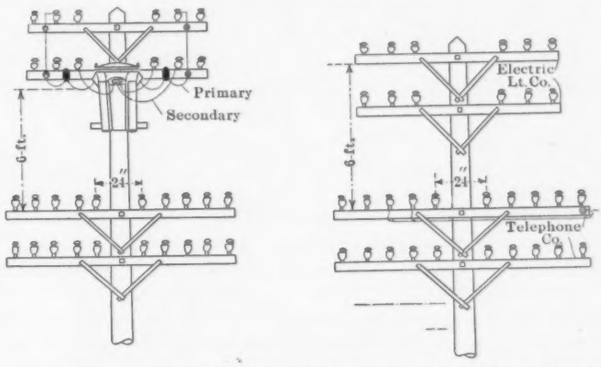
Angle Construction on 50,000-Volt Line in Montana.

wood cross-arms and three-part suspension insulators. The upper cross-arm is then occupied by one conductor and the ground wire. For turns like that shown, all wires are brought into a single vertical plane and are supported from suspension insulators carried on special steel triangle brackets, requiring no cross-arms. The ground wire is carried around the outer side of the pole at turns, and the pole itself is guyed as shown. This construction has now become standard for making all turns on the 50,000-volt lines of the Butte associated companies.

## JOINT POLE-LINE CONSTRUCTION.

An important consideration bearing on the subject of joint pole-line agreements, as pointed out by Mr. J. L. Spore, Toledo, Ohio, in presenting his report on joint telephone and electric-light construction before the convention of the Ohio Electric Light Association at Cedar Point, Ohio, last month, is the effect such agreements may have on the financial standing of the companies involved.

To the company having a joint-line agreement, with




Figs. 1 and 2—Disposition of Electric Light and Telephone Wires on Joint-Pole Line.

therefore very little independent construction of its own, and desiring to float an issue of bonds the financier might be less willing to advance money on the ground that a joint pole line is not a tangible asset of either company. But if the joint pole-line agreement were so worded that neither party thereto forfeited any of its original franchise rights for the construction of independent lines in the streets, the principal objection to the joint pole line from a financial standpoint would be eliminated.

There is also a deep-rooted prejudice against joint-pole construction among linemen of both telephone and electric-light companies, on the ground of greater danger to themselves in the performance of their duties, but this is due mainly to haphazard methods of construction.

The installation of joint-pole construction with substantially the clearances shown in the illustrations would do much toward overcoming the linemen's prejudice against this type of construction.

In closing, the author declared himself in favor of having every wire on any street occupy its proper place on a good, safe, well-constructed joint-pole line. If there are so many wires that it becomes necessary to use steel towers in place of poles, and the cost of underground construction is prohibitive, then let steel towers be used.

## SCREEN COVER FOR MANHOLE WORKERS.

To protect its workmen in manholes in the downtown section of Chicago, where traffic is dense, the Commonwealth Edison Company provides each crew with a screen cover of the same size as the standard manhole cover. After the men have gone below, this screen is dropped into place on the sills of the manhole framing, and it admits ventilation to the underground chamber while protecting both workmen and passers-by from accident. The screening is of ¼-in. interwoven steel wire and is strong enough to bear the weight of a horse. In several cases serious accidents have been prevented by these screens.

## RECENT TELEPHONE PATENTS.

### COMBINED ALARM AND TELEPHONE SYSTEMS.

The alarm system has been adapted to the automatic telephone system by Messrs, J. W. Lattig and C. L. Goodrum, of Rochester, N. Y. According to their method the alarm code is preceded by such a set of impulses that a special second selector is picked up. This is assoicated with the recording circuits. The alarm code is there recorded. It will thus be understood that the first series of impulses is just the same as would be sent were a regular call being made for a number corresponding to the special second selector. This patent has been obtained by the American Automatic Telephone Company by assignment.

Mr. E. E. Clement has also patented a combined system, but for use with manual switchboards. The alarm-recording apparatus ends on a special plug. The sender repeats its code numerous times, first quickly to flash the line lamp and then more slowly for record purposes. When the lamp shows an alarm arriving, the recording circuit is plugged into the jack and the record thus forwarded.

### PARTY-LINE SYSTEM.

A step-by-step party-line lock-out system has been patented by Mr. W. F. Marten, of Oakland, Cal. There are three features belonging to the substation selector. These are, first, the selector; second, the connector, and, third, the release. The first steps up the blocking wheels all in unison. The second connects in the desired station, it alone having the block removed. The third removes the retaining pawls, permitting all stations to restore to normal. The block is removed from all stations in the normal position. Therefore, if desired, all may be called simultaneously.

### RECEIVER SUPPORT.

Mr. T. S. Ludwig, of Sandusky, Ohio, is the patentee of a receiver-supporting arm with linkage to operate the switch hook. The arm swings about a horizontal pin. When thrown back out of position it depresses the hook lever.

### COMBINED TELEPHONE AND ALARM.

Mr. H. G. Webster, of Chicago, has obtained a patent for a combined telephone and alarm system. The circuits are so arranged that an alarm may be sent in whether or not the telephone is in use. The alarm is initiated by the release of a code wheel which is legged off one side of the line. This disturbs the balance of a differential relay, which therefore follows each impulse record or displays the signal at the central office. This patent is assigned to the Kellogg Switchboard & Supply Company.

### NEW SWITCHBOARD KEYS.

For party-line working the best results are obtained if the ringing keys have indicators which show the key last depressed. When this is done a second ring may be given without again asking the calling party the ring of the desired station. Many forms of special indicators have been devised to accomplish this, but one of the best arrangements merely leaves the key button in an intermediate position. It is this type which is described in a patent granted to Mr. W. E. Harkness, of East Orange, N. J., and assigned to the Western Electric Company. In this key the usual button is replaced by a turn button and the key springs are actuated by turning the button about a vertical axis. When a button is released the ringing ceases but the button returns to an intermediate position. As each button when turned releases all others the indication is perfect. The buttons are locked in these intermediate positions by a latching bar, which is momentarily driven into the release positions as any key is thrown.

Another type of key has been invented by Mr. H. E. Schreeve, of Millburn, N. J. The patent for this key is also assigned to the Western Electric Company. This key is designed for repeater circuits, and a single handle serves to operate one or more sets of switch springs as may be desired. The key plunger is arranged to slide along a base piece beneath which the spring sets are mounted. As the handle is pushed along the wedge slides successively into the different sets, operating one after the other cumulatively. At the beginning of its stroke the plunger may be depressed into a lower set of springs and thereupon pushed forward in this position as desired.

### CIRCUIT SYSTEMS.

Mr. E. R. Hobbs, of Buhl, Idaho, is the inventor of a switchboard circuit system of the common-battery two-wire type. One feature lies in putting a busy test on a calling line as soon as a call is originated and before the operator has responded. Another is the provision of a control relay for the calling supervisory.

In a system invented by Mr. F. R. Parker, of Chicago, the lines are arranged upon the two-wire plan, but relays are dispensed with. The line lamp is in series with the line and becomes shunted out upon the response of the operator by the low resistance of her cord circuit. On the other hand, the subscriber's instrument shunts out the supervisory lamp.

A patent granted to the estate of the late A. M. Bullard describes a reverting busy test system. When a call is made for another station upon the same line, if the operator fails to note this condition she will get a continuous busy test and refuse connection. With the semi-automatic system this will occur in practically every case unless special preventive means are provided. The circuits described by Mr. Bullard provide a special tone to replace the usual busy test, provided the line tested be connected to the same connecting circuit as that affording the test. This patent is assigned to the Western Electric Company.

Mr. J. G. Mitchell, of Cleveland, Ohio, has obtained a patent, which he has assigned to the North Electric Company, describing a trunk circuit for connecting a main and a branch exchange. The branch exchange is signaled by a ring over the trunk. This sets and locks a signal. The trunk operator answers by using a listening key, and upon plugging to the desired line and receiving a response the battery at the distant office supplies current to operate the supervisory relay, the windings being bridged around condensers included in the trunk circuit.

### REPEATER CIRCUIT.

A repeater circuit is the subject of a patent granted to Mr. H. R. Stone, of Providence, R. I. He uses a four-wound coil and an adjustable-core control-repeating coil. Two of the windings of the four-winding coil are included respectively in the two sides of the main line. Of the remaining windings one connects with the receiver part and one with the transmitter part of the repeater. The two windings of the adjustable coil are also included respectively in the transmitting and receiving circuits. The reaction of the reinforced current in the transmitter circuit upon the receiving circuit arising in the main-line coil is balanced by the opposite reactions set up in the adjustable coil. Adjustment must be effected for each connection.

### PARTY-LINE SYSTEM.

A six-party selective system has been invented by Mr. G. L. Goodrum, of Philadelphia. He uses positive and negative currents and alternating currents in conjunction and differentiates between the two sides of the line. Three relays are legged off each side of the line to ground. One responds to any direct current, while two are polarized and respond respectively to positive and negative. Three bells are legged off each side of the line through the contacts of the relays of the other side. The polarized relays close their bell circuits while the non-polarized relay opens its bell circuit. This gives the six combinations, no current, positive current and negative current on each side of the line, while ringing upon the opposite side.

# Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

### Generators, Motors and Transformers.

*Acoustic Tests of Machines.*—W. BURSTYN.—The noise caused by machine parts in motion often permits conclusions concerning the operation. It is therefore frequently helpful to listen to the noise of a certain part of a machine. For this purpose the author uses a piece of ordinary gas pipe ½ m to 1 m (1½ ft. to 3 ft.) in length. One end is pressed against the ear and the other is placed on the part of the machine which is to be tested. In order to hear electrostatic alternating fields a small diaphragm of tin foil is placed on the end of the pipe. A mica diaphragm with a small piece of iron attached will serve to detect magnetic stray fields. The sensitiveness is not very great in either case, but might be improved by special arrangements.—*Elek. Zeit.*, Aug. 8, 1912.

*Large Direct-Current Motors Without Starting Resistances.*—CARL TRETTIN.—A conclusion of his article on the use of large direct-current motors without starting resistances. The author finally discusses two means for reducing the starting current. One is the use of a compound winding in which a strong starting torque is obtained by means of strengthening the field. The second method is the gradual variation of the voltage with the aid of starting machines.—*Elek. Zeit.*, Aug. 8, 1912.

*Predetermining Induction-Motor Characteristics.*—C. R. MOORE.—The first part of a serial in which the author collects and compares various graphical and analytical methods for predetermining the characteristics of induction motors. Along with this the author publishes the results of an extensive experimental investigation carried out on actual machines to elucidate or demonstrate various points which are introduced. The first part is confined to a consideration of the rotating field and a comparison of the induction motor with the transformer.—*Gen. Elec. Review*, August, 1912.

*Rotary Converters.*—J. L. McK. YARDLEY.—An illustrated article giving characteristics of commutating-pole rotary converters. It is shown that the introduction of the commutating pole has gradually increased the permissible output per pole. The results of commutation tests are given and a number of typical rotary converters of this kind are described and illustrated.—*Elec. Journal*, August, 1912.

### Lamps and Lighting.

*The Starting of the Carbon Arc.*—A. OCCHIALINI.—An account of an experimental investigation supplementing the author's former researches on the phenomena observed in the starting of an arc between carbon electrodes. Under ordinary conditions—that is, when the anode is cold—two different successsive periods may be distinguished in the starting of the arc, the first of which shows the characteristics of a spark and the second those of an arc proper. The first period, that of a spark, occurs only when the anode is initially cold, while the second period requires a hot anode. If the arc is started with an artificially preheated anode, the first period, that of the spark, is missing. The author concludes that the preliminary spark period has the function of heating the anode so as to permit the real arc period to commence. The high temperature of the cathode, which heretofore has been considered the only requirement of an arc, produces, therefore, only the preliminary spark, and not until the anode has been heated sufficiently by means of the spark will the arc itself start. For the experimental investigation a kinematographic method was used.—*Phys. Zeit.*, Aug. 1, 1912.

*Photo-Electric Photometer.*—J. ELSTER AND H. N. GEITEL.—The authors have heretofore proposed to use the photo-electric effect on metals for measuring light intensity, since the intensity of the photo-electric current is proportional to the intensity of the exciting light within wide limits. The zinc spherical photometer for measuring ultra-violet radiation from the sun is based on this principle and has proved very successful in practice. The authors also emphasize that the same principle can well be used for measuring radiation within the visible spectrum, the active member being a cathode surface of pure alkali metal in a rarefied gas. They describe an instrument in the structure of which recent advances in the construction of alkali metal cells and also recent improvements in electrical measuring instruments are embodied to advantage. The instrument is primarily intended to be used for measuring the intensity of light within the visible spectrum of sunlight and daylight, but with the use of very sensitive ammeters it may also be used for determining candle-powers down to a few thousandths of a hefner candle.—*Phys. Zeit.*, Aug. 15, 1912.

*Chemistry and Illuminating Engineering.*—O. KRUH.—A paper read before the Electrical Society of Vienna, giving an outline of the results of chemical research along the lines of recent progress in electric lamps. Arc lamps with impregnated carbons, mercury-vapor lamps and incandescent lamps, especially metallic-filament lamps, were discussed in succession.—*Elek. u. Masch.* (Vienna), July 28 and Aug. 4, 1912.

*Direct and Indirect Lighting.*—SYDNEY W. ASHE.—An illustrated account of acuity tests in a particular room illuminated in turn with direct, indirect and semi-indirect lighting.—*Gen. Elec. Review*, August, 1912.

### Generation, Transmission and Distribution.

*Large Steam-Operated Electric Power Stations.*—G. KLINGENBERG.—A continuation of his long illustrated paper on the design of large steam-operated electric power stations. The present instalment deals with the switchboard and the situation of the plant. The author compares the cost of electrical transmission of energy with the cost of transportation of coal.—*Elek. Zeit.*, Aug. 1, 1912.

*Large Steam Stations.*—G. KLINGENBERG.—The conclusion of his long paper, read before the German Association of Electrical Engineers, on fundamental principles in the design of large generating stations operated by steam. The author concludes his comparison of the cost of electric power transmission and the transportation of coal by rail. The results are given in a number of diagrams which permit the direct determination of the commercially economical distances to which electric power may be transmitted from a generating station operated by coal. Other diagrams give the cost of transmission per kw-hour as functions of the distance and the amount of power transmitted. It is shown that with "brown coal" (lignite) electric power transmission is almost always cheaper than transportation of the fuel by rail and that even cheap transportation by water cannot compete in many cases with electric transmission. But, in general, the erection of very large three-phase generating stations operated by steam is only economical if lignite or some other very cheap fuel is available. In other words, with expensive fuel, transportation is cheaper than electrical transmission. Lastly, detailed data and figures showing the economy and generating costs in electric generating stations are given as functions of the size of the generating sets and the load factor. —*Elek. Zeit.*, Aug. 8, 1912.

*Small Water-Power Plant.*—An article giving details of a rural hydroelectric distribution scheme, utilizing the en-

ergy derived from a 15-hp to 20-hp water-power plant and transmitting electricity over a maximum distance of 4.5 miles. The installation is situated at Cotentin, on the banks of the River Saire, in France. Three-phase currents are generated at 120 volts between phases and neutral and are distributed at this voltage in the immediate vicinity of the station. For transmission the voltage is raised. The pressure on the longest transmission line is 5000 volts. Transformer stations are provided at convenient central points. In order to accommodate the many small consumers, such as farmers who have but a few lamps in their stables, energy is sold by contract, from sunset to 11 p.m. all the year and from 5 a.m. to daylight during the winter. To avoid restricting the number of lamps installed, which is so frequently the effect of a contract tariff, an ampere-year basis of charge is adopted and current-limiting devices are installed. A uniform rate of $21 per ampere-year is levied, with a minimum of $15 for three lamps simultaneously in use. Some consumers have only one or two 16-cp lamps, but on the other hand there are farmers who have as many as twenty lamps in their stables alone.—London *Elec. Review,* Aug. 2, 1912.

*Competition of Coal-Mine Power Plants with Central Stations.*—A. Hartmann.—The author states that in some places in Europe there is a tendency for power plants in coal mines and other large industrial works to sell energy in competition with central stations at a rate which it is absolutely impossible for the central station to meet. The author severely condemns such ruinous competition.—*Elek. u. Masch.* (Vienna), July 28, 1912.

*Motor Control.*—H. L. Beach.—An article, illustrated by diagrams, on automatic motor starters and controllers.—*Elec. Journal,* August, 1912.

### Traction.

*London Subway.*—An article on the extension of the Central London Railway to Liverpool Street. The construction of the new track does not differ materially from that of the ordinary track. A number of the joints in the third-rail are thermit-welded. An interesting feature of the extension is the system of track-circuit signaling which has been installed by the Mackensie & Holland Westinghouse Power Signaling Company. The whole of the Central London line is also being converted to this system, in which alternating current is employed.—London *Electrician,* July 26, 1912.

*Cologne.*—R. Krüger.—The conclusion of his illustrated article on the suburban railway system of the city of Cologne, Germany.—*Elek. Zeit.,* Aug. 8, 1912.

### Installations, Systems and Appliances.

*London.*—A long illustrated description of the Deptford generating station of the London Electric Supply Corporation. It is declared to be the pioneer high-tension electric generating station of the world, and some details of its early history are given. The present station is feeding four distinct types of distribution systems, as follows: (1) The original 85-cycle, 10,000-volt, single-phase system used for lighting purposes; (2) a direct-current, three-wire system at 460 volts and 230 volts, used for motor service and lighting purposes; (3) a three-phase, 25-cycle, 6600-volt system for large consumers or for traction purposes, and (4) the single-phase, 6600-volt, 25-cycle system used for the Brighton Railway. All of the high-tension conductors are laid out in such a manner that each conductor and isolating switch is inclosed in an earthed shield. One of the several advantages claimed for this system is that the series transformers—a weak point in all other systems—are clamped outside the earthed covering, thereby making a failure at this point almost impossible. The arrangement for the series transformers is shown in Fig. 1. It is pointed out that the usual arrangement of series transformers constitutes a weak link, as has been proved on more than one occasion at other stations, when the transformers failed. In the arrangement here used any such trouble is impossible. The only difficulty which naturally arises is that the indications may be affected by eddy currents, but this is obviated by making a small gap in the lead sheathing at one side of the transformers, as indicated in the illustration.—London *Electrician,* Aug. 9, 1912.

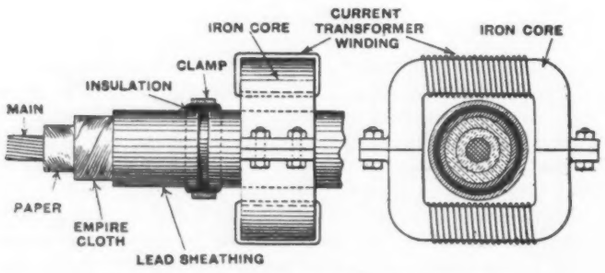


Fig. 1—Application of Series Transformer.

*Synchronizing.*—Harold W. Brown.—An article giving a series of fifteen diagrams which show the principal connections employed for synchronizing two or more machines by lamps or synchroscopes, or both, to a single bus or a double bus.—*Elec. Journal,* July, 1912.

*Bus and Switch Compartments.*—E. Bern.—An illustrated article in which the author discusses the design of fireproof compartments for medium high-voltage apparatus. He states some of the advantages of brick and concrete bus compartments, the dimensions being usually governed by allowable distance to "ground," and to a less extent by the apparatus to be housed. He also gives approximate dimensions for use with various voltages, and discusses and illustrates several types of disconnecting switches and methods of mounting them. The proper location of oil switches with respect to the buses is also discussed.—*Gen. Elec. Review,* August, 1912.

### Wires, Wiring and Conduits.

*Aluminum Conductors.*—F. Marguerere.—As a disadvantage of aluminum conductors it is sometimes claimed that their large sag and the resulting increased expense for pole construction consume to a great extent the saving otherwise resulting from their use. The author thinks that this criticism is wrong, and is due to a misconception in the standardization rules of the German Association of Electrical Engineers. In these rules it is assumed that thin wires are covered with thinner layers of ice or snow than thick wires. But practical experience shows that it is not so in general. In Norway he found that telephone wires of 4 mm (5/32 in.) and aluminum cables 300 sq. mm (12/29 in.) were coated with equal thicknesses of ice. The author makes a suggestion as to how the standardization rules can be changed. He finally mentions that high-tension lines of 10,000 volts or more always remain free from snow.—*Elek. Zeit,* Aug. 8, 1912.

### Electrophysics and Magnetism.

*The Efficiency of Generation of High-Frequency Oscillations by Means of an Induction Coil and Ordinary Spark-Gap.*—G. W. O. Howe and J. D. Peattie.—An abstract of a British Physical Society paper. The apparatus used was similar to that employed in small radio-telegraph stations. A 10-in. induction coil operated from battery cells through a mercury interrupter gave power to an oscillatory circuit containing a spark-gap between spherical electrodes. Coupled to this circuit was another oscillatory circuit representing the aerial and containing a variable resistance which constituted the high-frequency load. The input, output and efficiency were determined for various degrees of coupling, various aerial decrements, different lengths of spark-gap and with various primary voltages, the object

being to determine the effect of these various factors on the working of a small radio-telegraph station. A second part of the paper dealt with some oscillographic records of the primary and secondary currents of the induction coil. These disclosed many interesting features and explained several peculiarities in the working of the coil, especially the variation of input with spark length. This was shown to be due to the particular phase, at the moment of "make," of the remnant current in the primary induced by the oscillations in the secondary produced by the last spark. This depended on the time which had elapsed since the last spark. —London *Electrician*, July 19, 1912.

*Velocity of Emission of Electrons.*—R. A. MILLIKAN.—An abstract of an American Physical Society paper on the effect of the character of the source upon the velocities of emission of electrons liberated by ultra-violet light. The author had formerly made experiments in which the positive potentials acquired by metals under the influence of ultra-violet light were greatly in excess of those obtained by other observers. This "high-speed emission" he has now investigated. High-speed emission is obtained only with spark sources, and variations in the electrical constants of the spark circuit (capacity, self-induction, spark length, energy output) are found to produce large variations in the potential photo-current curves. The types of these curves for quartz mercury lamp sources and for spark sources are very dissimilar. The author describes various experiments which show conclusively that the high velocities obtained with a spark source are due to the light itself and not to secondary effects of any description.—*Physical Review*, July, 1912.

*Earth's Magnetic Field.*—W. F. G. SWANN.—A paper in which the author formulates a theory for the earth's magnetic field as a phenomenon arising out of the radiation of the earth. The easiest explanation seems to be based on the existence of electric currents brought about by the radiation.—*Phil. Mag.*, July, 1912.

### Electrochemistry and Batteries.

*Electro Analysis.*—F. A. GOOCH AND W. L. BURDICK.—A paper on electrolytic analysis with platinum electrodes of light weight.—*American Journal of Science*, August, 1912.

### Units, Measurements and Instruments.

*Kilowatt as the Only Unit of Power.*—In a continuation of the stenographic report of the proceedings of the recent convention of the German Association of Electrical Engineers the motion of the committee for standardization of machines is mentioned. This machine was made not only for the German Association of Electrical Engineers but also for the Society of German Engineers (comprising mechanical and civil engineers). It provides that, beginning with Jan. 1, 1914, the kilowatt shall be the only unit of power. Until that date the kilowatt and the horse-power are both permissible.—*Elek. Zeit.*, Aug. 8, 1912.

*Measuring High Alternating-Current Voltages with the Quadrant Electrometer.*—A. BAXMANN.—The quadrant electrometer can be used for measuring alternating-current voltages above 40,000 volts only with difficulty, owing to the rapid increase of the spark-gap required and to the occurrence of small sparks at different parts of the electrometer. These troubles may be overcome to a certain extent by inclosing the whole instrument in a vessel filled with carbonic acid compressed to 20 atmospheres pressure, but this involves considerable complication. The author describes how all the difficulties can be very easily overcome by the use of condensers. The experiments were made with ordinary commercial alternating current, employing a special transformer to produce the necessary high voltage. The arrangement is shown in Fig. 2. The voltage of the primary commercial source is measured by a voltmeter *V*. The voltage is then raised by means of the special transformer as shown and the ends of the secondary are connected each to one plate *I* of the condensers. The distance between plates *I* and *II* in the two condensers can be adjusted. The plates *II* of the two condensers are connected with the electrometer, one with the needle and the first pair of quadrants and the other with the second pair of quadrants. An adjustable air condenser *C* is connected

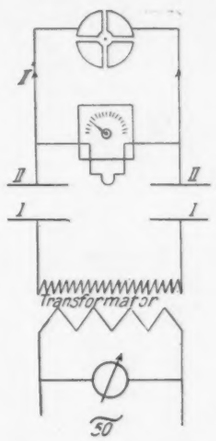



Fig. 2—Diagram of Quadrant Electrometer.

in shunt with the electrometer as shown. By adjusting the zero position of the needle of the electrometer the following simple relation between the voltage *V* and the deflection *a* of the needle can be obtained: $V^2 = a\,C$, where *C* is a constant. The author gives results obtained with this arrangement and shows how it may be used for determining the ratio of transformation in transformers.—*Phys. Zeit.*, Aug. 15, 1912.

*Vibration Galvanometer.*—H. F. HAWORTH.—An illustrated paper read before the British Physical Society on the maximum sensibility of a Duddell vibration galvanometer. The author shows that the maximum sensibility of a moving-coil vibration galvanometer as a voltage detector is obtained when the flux through it is so adjusted that the back emf of the coil is equal to, and in phase with, its ohmic resistance drop.—London *Electrician*, Aug. 9, 1912.

*Diurnal Variations of Electric Waves.*—W. H. ECCLES.—A note on a recent Royal Society paper. The natural electric-wave train radiating from a lightning discharge produces a disturbance in apparatus for the reception of wireless-telegraph messages. Normally these disturbances form a steady stream of loud or faint clicks in the receiving telephones. The rate at which they are received at a station varies from hour to hour during the whole day and also with the season; but as a general rule the disturbances—or "strays," as they are often called—heard at night are stronger and more frequent than those heard in the day. The change from day to night and from night to day conditions is very noticeable at sunset and sunrise. It is chiefly this transition period which is investigated in the present paper. It is found that very frequently there is not the gradual transition that might be expected, but instead a passage through a sharply marked minimum, amounting sometimes to a discontinuity. In order to explain the phenomena the author develops a hypothesis which is based on the proposition that the velocity of electric waves through ionized air increases with increasing ionization. Now, it is probable that the ionization produced by solar radiation increases, within limits, with higher altitudes in the atmosphere. Hence it follows that a system of waves with vertical wave fronts must suffer a forward tilting of the wave fronts as they traverse the heterogeneous medium, and the rays will follow curved trajectories having their concavity downward. This also explains many of the hitherto unexplained phenomena of wireless telegraphy, but to explain the stray minima found at sunset or sunrise it is

necessary to suppose that the process of ionization of the atmosphere at sunrise and the process of deionization at sunset produce a turbulence of the medium that leads to difficulty of propagation. It is shown in the paper that the existence of this turbulence is corroborated by observations on telegraphic waves coming from great distances.—London *Electrician*, July 26, 1912.

*Operators Required in Telephone Exchange.*—F. Ambrosius.—It is often desirable to know how many telephonic conversations are carried on simultaneously in order to determine how many operators are required in the exchange. With the aid of curves the author shows that the number of connections existing at the same time, and therefore the number of operators required at any hour of the day, are proportional to the current consumption in that hour.—*Elek. Zeit.*, July 25, 1912.

### Telegraphy, Telephony and Signals.

*Submarine Telegraphy.*—M. Roscher.—The author gives a review of the technical development of submarine telegraphy during the past sixty years, with special reference to changes in the types of cables, the methods of laying and the apparatus and connections.—*Elek. Zeit.*, July 18, 1912.

*Protection of Telegraph and Telephone Lines.*—Girousse.—A paper on the troubles and dangers inflicted on telephone and telegraph lines by adjoining high-tension lines and on methods for the protection of the former.—*Soc. Internat. des Elec.*, June, 1912; abstracted in *La Lumière Elec.*, July 13, 1912.

### Miscellaneous.

*German Association of Electrical Engineers.*—A continuation of the report of the recent annual convention in Leipzig. The number of members is now 5096. The association owns bonds, etc., to the amount of $37,000.—*Elek. Zeit.*, July 18 and 25, 1912.

*German Röntgen Society.*—A report of the eighth congress of the German Röntgen Society, held on April 13 and 14. There were 463 members present. Most of the sixty-four papers read dealt with problems of medicine. Jaksch discussed the particularly favorable action of the silver filter, which was confirmed by Dessauer but which Rosenthal considered to be unexplainable from a physical standpoint. Koehler and others advocated the leather filter and Walter an aluminum filter. Schlee showed a new instrument of Loewenthal's which is based on the speed of the discharge of an electroscope due to the ionization of air by Röntgen rays.—*Elek. Zeit.*, July 18, 1912.

*Rubber.*—An abstract of the report of last year's work of the Rubber Central Bureau for the German colonies. Methods for improving low-grade gutta percha have been satisfactorily evolved. They are commercially profitable wherever large quantities of raw material are regularly available for treatment. As to synthetic rubber, it is not thought that this will have any influence on the price at present. The viscosity of rubber gives valuable information on its quality. The coagulating agents at present used in German East Africa have a bad effect on the rubber produced, but a new coagulating method which gives excellent results has been evolved. External appearance is often deceiving. Apparently poor-looking rubber which brings a low price is often superior to better-looking kinds which bring a higher price. To heat, roll or press rubber afterward spoils it completely.—*Elek. Zeit.*, July 18, 1912.

*Lord Kelvin.*—A long abstract of H. Dubois' recent lecture before the British Institution of Electrical Engineers on Lord Kelvin's work in the fields of electricity and magnetism.—*Elek. Zeit.*, July 25, 1912.

*Poincaré.*—A sketch, by A. Blondel, of the life and work of the late Henri Poincaré, with a photograph showing Poincaré in his library.—*La Lumière Elec.*, July 27, 1912.

*Recent Developments in the Electrical Art.*—Elihu Thomson.—An address of a general nature made on the occasion of the award of the Elliott Cresson medal of the Franklin Institute to Professor Thomson. Recent progress in all fields of electrical engineering is briefly sketched.—*Journal Franklin Institute*, August, 1912.

# Book Reviews

Machine Shop Mechanics. By Fred H. Colvin. New York: McGraw-Hill Book Company. 172 pages, 116 illus. Price, $1.

This exceedingly practical little volume, written primarily for those who have not had a technical education, explains in simple form the elementary principles of mechanics that govern the every-day processes and mechanical effects with which machine-shop workers come into contact in the course of their work. Among the topics discussed are: Levers—the amount of work they do and how to measure it; friction; heat and its effects; the horse-power transmitted by belting and gearing; the blocks and tackle; centrifugal force; strength of materials; hydraulics; the impact of a drop-hammer, and shafting, beams and force diagrams. It is written in an easy style and avoids much of the obscurity with which textbooks are often burdened. The questions and answers given at the end of each of the twenty chapters, together with descriptions of a number of simple experiments, combine to make the book one that will be decidedly helpful to the machinist who wishes to learn the "why" of things associated with his trade.

Valuation of Public Service Corporations. By Robert H. Whitten, Ph.D. New York: The Banks Law Publishing Company, 1912. 798 pages. Price, $5.50.

The most important and systematic treatise on the legal and economic phases of the valuation of public utilities yet written for the engineer. The author was singularly qualified to prepare such a work from a wholly unprejudiced standpoint by reason of his service with the Public Service Commission for the First District of New York. Appreciation of the public importance of this subject seems to grow daily, and there has been marked need of a thorough and systematic treatment from the sides on which Dr. Whitten has attacked it. In preparing the volume, unpublished reports of special masters in equity, reports of special arbitrators and appraisal commissioners appointed by courts, decisions of state railroad and public service commissions and reports of appraisers appointed by local authority were all consulted. These reports and opinions are quoted from, where essential, at such length that practically all the available material is brought together.

Among the major subjects treated are standards of value, land valuation, pavement over mains, donated property, property constructed out of surplus, average versus present price, piecemeal construction, working capital, bond discount, depreciation, going concern, franchise value, rate of return, and others. The final chapter comprises a bibliography of valuation and depreciation. A table of the law cases cited is also included after the table of contents. The volume is given over wholly to discussions of law, economics and theory, with no attempt to show the engineer how to conduct the actual details of an appraisal. Depreciation and going-concern value are treated with care and at much length. In view of the controversial status of many of the questions presented the author wisely presents each problem from all sides and discusses it without attempting to say the final word or reach a positive conclusion. The volume is equipped with an excellent index. Besides bringing together for the first time practically all of the legal and economic information which the engineer needs as a guide in valuation work, it will also interest managers of public service companies, accountants and attorneys.

# New Apparatus and Appliances

## STARTER FOR SLIP-RING MOTORS.

A new form of non-reversing starter for constant-speed, slip-ring motors of 5 hp to 15 hp has recently been placed on the market by the Westinghouse Electric & Manufacturing Company. The starter is self-contained and of the general appearance shown in the illustration. It is not applicable for speed control. There are three sets of contacts

Starter for Slip-Ring Motor.

one for each phase, and three arms, each carrying contacts for one of the phases. The motor is started by moving the handle gradually from the "off" position over the six steps to the "running" position, where it is locked. The handle cannot be left in any intermediate position. In the "running" position all resistance is short-circuited. The resistor is composed of wire wound on porcelain tubes and then coated with a heat-proof and moisture-proof varnish, making it practically indestructible The only wearing parts, the contacts, are easily and inexpensively renewed. The face plate and the resistors are inclosed. The features of the starter, attention to which is directed by the manufacturer, are its simple construction, durability, the ease of access to all its parts and the protection of the resistors and switching device by covers.

## ELECTRIC AUTOMOBILE WITH TWO-SPEED TRANSMISSION.

The new electric roadster built by the Church-Field Motor Company, Sibley, Mich., includes among other departures from ordinary electric-vehicle design the features of a two-speed transmission, ten-point speed control, simplicity of control levers and underslung construction on a long wheelbase. One of these cars, exhibited on the beach at Cedar Point, Ohio, during the Ohio Electric Light convention, displayed its ability to make good time over unfavorable road surfaces, besides demonstrating its easy-riding qualities by being run over a telegraph pole and other beach obstructions without discomfort to the occupants.

The two-speed planetary transmission used in the Church-Field car marks a distinctive step in electrically driven vehicles, putting the battery-driven car on a footing with gasoline machines in climbing hills, and minimizing energy consumption and battery wear. The controlling lever is mounted on top of the steering column, and with only three moving contacts affords ten speed points both forward and backward. The motor, of special design, is connected to the rear axle by a shaft that gives a straight-line drive. The underslung frame of the car is of steel and is carried on vanadium-steel springs. The wheelbase measures 100 in. Twenty-six 180-amp-hr. cells comprise the battery equipment.

## ELECTRICALLY DRIVEN CRUSHING ROLLS AND SKIP-HOIST.

At Martinsburg, W. Va., are located the quarries and crushing plant of the National Limestone Company. The property owned consists of about 1000 acres, on which are four limestone deposits. Of course, economy is sought in the operation of the works, and the mechanical breaking up of rock can ordinarily be performed with less expense than would be the case if dynamite were used. The steam shovel is a very large one, capable of taking great stones. The crushers have also a capacity enabling them to take stones up to the maximum size that can be handled by the shovel.

Not a great deal of water comes into the quarries to give trouble. Yet it is important that the pumping arrangements shall be thoroughly reliable so that attention can be given to the main operations. Two Cameron pumps are used to dispose of the water.

The actual crushing is done by a pair of enormous rolls, each 6 ft. in diameter and 7 ft. long. Their cylindrical surfaces are provided with numerous projections or knobs arranged in circumferential and longitudinal lines. All knobs are essentially alike with the exception of those in two longitudinal rows on one of the rolls. The great majority are about 2 in. in height. A circumferential row is in reality an annular rib interrupted here and there. As the rolls are given a rotational movement, the knobs have front and rear faces. These are planes inclined toward each other above. Thus, the forward face is a plane extending upward and backward. The inclination to the cylindrical surface is not a steep one. The other knobs, arranged as already said in two longitudinal rows, are of superior height. Their forward faces are quite steep.

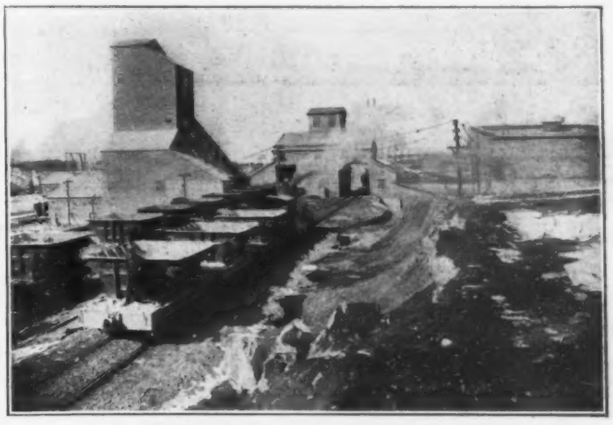


Fig. 1—Transformer Station and Skip-Hoist.

These knobs arranged in two lines diametrically opposite each other are known as "sluggers." They are prominent, if not the chief, agents in shattering the rock. The two rolls are placed alongside each other, so that their respective circumferential rows come immediately opposite; that is, the arrangement is not a staggered one. When in operation the

rolls rotate in opposite directions—toward each other, viewed from above.

The crushing rolls are an invention of Mr. Thomas A. Edison and were furnished by the Edison Crushing Roll Company, of Stewartsville, N. J. Each giant roll rotates with a shaft 21 in. in diameter passed through it. Six-foot giant rolls readily take care of stones weighing 15 or more

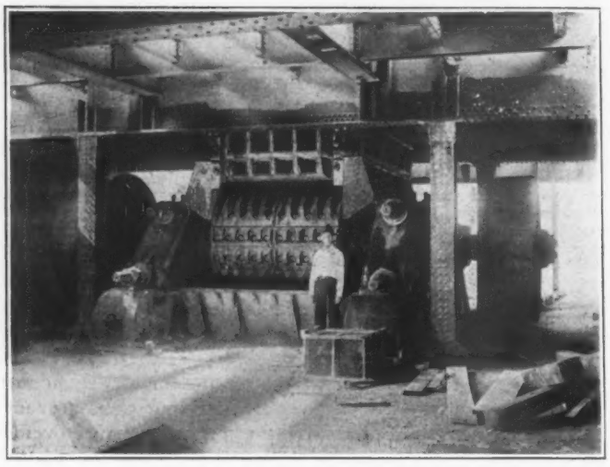


Fig. 2—Rock-Crushing Rollers.

tons. It will thus be seen that such large crushers as the giant rolls at Martinsburg have a capacity well up to, if not beyond, that of the largest of the steam shovels. The energy of such a pair of rolls rotating at 165 r.p.m. is estimated in effect at about 4,000,000 ft.-pounds. It is important to have this accumulated energy available. When the rock is fairly gripped both rolls tend to rotate in unison. Because of the enormous amount of work done in such a short time the rotative speed goes down sharply and then slowly recovers itself. The shattering of an 8-ton rock will require perhaps thirteen seconds from start to finish.

At the Martinsburg plant the giant rolls are driven by a pair of electric motors, each having an output of 200 hp. When it is understood that the power demanded at the most

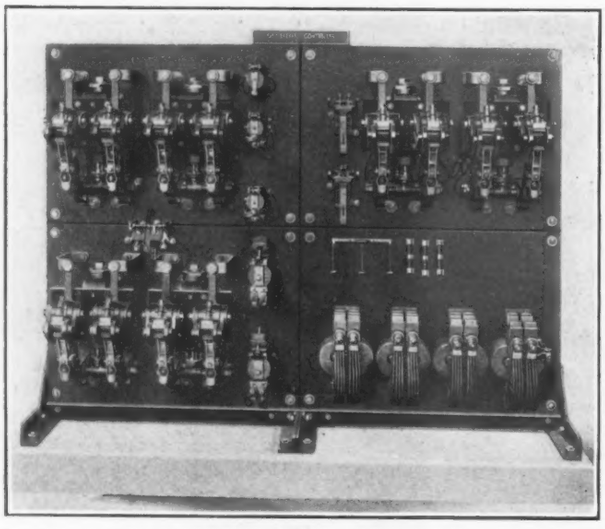


Fig. 3—Skip-Hoist Control Board.

intense instant may rise as high as 3000 hp or 4000 hp, it will be seen that it is very necessary to store up energy in the rolls—just as with an ordinary flywheel. The maximum demand continues, however, for a very short interval—perhaps half a second.

Electricity is employed generally in the operation of the plant. It is only the quarry locomotives, the drills, etc., that are driven by other means. The energy is bought from a nearby line and is stepped down to a moderate voltage. The large power requirements are in connection with the crushing rolls and the skip-hoist. The two rolls are not geared together or in any other way inflexibly coupled. The method employed is to drive each roll with an independent motor and independent belt. The motors are located 30 ft. or 40 ft. away from the rolls and have their angular velocity reduced to about one-third in communicating their drive to the roll shafts. As both are on one side and the rolls are rotated in opposite directions, the slack side of one belt is next the floor. This is supported by an idle roll.

The skip-hoist is provided with a two-track incline, having a slope of 45 or 50 deg. There are two large skips which counterbalance each other in making the trips up and down. The load capacity is 15 tons of rock. At the top of the hoist the rear wheels of the skip continue on up the incline on two rails, while the forward wheels follow two other rails which, after making a rather sharp bend, enter the screen house on the horizontal. The effect of sending the rear wheels up one pair of rails while the forward wheels pursue a course 45 or 50 deg. different, the same vertical planes being maintained throughout, is to dump the skip. When the loaded skip has reached its final position the unloaded one has also just reached its lowest point.

The hoisting drums are driven by a powerful motor which

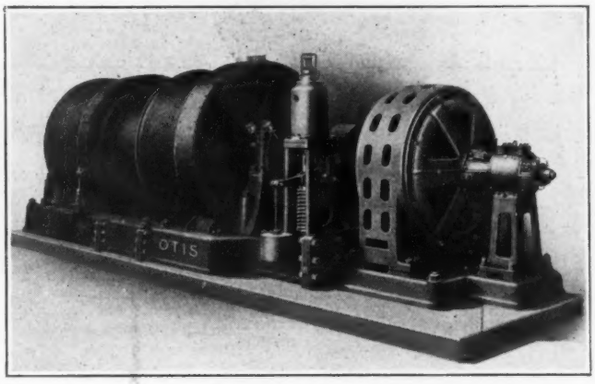



Fig. 4—Double-Drum Alternating-Current Hoist.

effects its drive through suitable reduction gearing. There is a spring-applied brake which is released by electromagnetic means This brake brings everything to rest at the moment of stoppage. There is also a stop-motion switch which slows down and stops the skip in a manner entirely automatic. In addition, there is a small direct-current generator which is the source of energy for the accelerating and load magnets located on the controller.

The master switch is the only controlling device with which the operator has to do. By its means the skip-hoist is started up in either direction. It is not at all necessary that this switch be placed near the controller. Each contact made with the master switch effects a predetermined operation by means of the controller.

On the controller are arranged fourteen electromagnetic switches. By their means are carried out such operations as the reversal of the motor, its proper acceleration, the lifting of the brake, the slowing down and complete stoppage at the termini, and also the adjustment of the speed and slow-down to a constant point independently of the load. To these are applied such names as "reversing switch," "accelerating magnet," "auxiliary brake magnet," etc. Other magnetically operated devices are designed for emergency use. These come into action in case of overload, failure of the circuit, slacking of the hoisting cable, etc.

The main-hoist motor is operated by alternating current. Most of the magnets are, however, operated by direct current supplied by a small continuously running motor-generator set. This generator must not be confused with the

direct-current auxiliary accelerating generator previously mentioned.

The first contact of the master switch closes the circuit for the single common wire connected with the five accelerating magnets. The generator supplying the power is located on an extension of the main motor shaft. However, no power will be actually delivered until this shaft starts up. The five accelerating magnets will, accordingly, not come into action at once.

The second contact of the master switch closes the circuit to the direct-current load magnets. These will come into action during the slow-down period when the proper contacts on the stop-motion switch are made. Until then these load magnets remain inactive but in readiness to operate.

The third and last contact of the master switch closes the circuit for the reversing switch. The result is the admission of current to the main motor. Simultaneously, electricity is admitted to the brake magnet and also to the first two accelerating magnets. The motor now gets under way, slowly. The auxiliary accelerating generator mounted on the shaft produces current of higher and higher voltage as the motor speeds up, and the rest of the accelerating magnets go in successively, short-circuiting the rotor resistance in steps and permitting the hoist motor to attain full speed. The loaded skip will now be going up the incline at maximum speed.

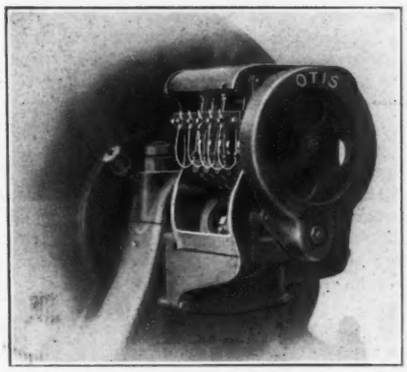



Fig. 5—Slow-Down and Stop-Motion Switch.

However, as the upper terminus is approached, the stop-motion switch mounted on the end of the hoist drum shaft where it is driven by spur gearing operated by the drum shaft comes into action. Its office is to slow down and ultimately stop the hoist. This duty is performed in an absolutely automatic manner whether the master switch is swung over to center or not.

When a point in the skip travel is reached which has been determined upon in advance the first contact on the stop-motion switch automatically opens, with the result that the line to the accelerating magnets is interrupted, thus allowing four of them to drop back and insert the rotor resistance in series with the rotor. Immediately following this, the load-magnet circuit is made. A number of operations are now accomplished one after the other through the agency of the first two accelerating magnets and the two load magnets. These operations result in a further slowing down. The slow speed is kept constant independently of the load.

Just before the skip reaches the limit of movement both sides of the reversing-switch circuit are opened by the stop-motion switch. The opening of the reversing switch interrupts the circuit to the motor and brake. The loaded skip now comes to rest at the top and the unloaded one at the bottom. It requires about fifty-four seconds to make a round trip over an incline 140 ft. in length. The main motor which operates the hoist is of the induction type and develops 375 hp. It is furnished with collector rings and is fed from a three-phase, 60-cycle, 440-volt circuit. The skip-hoist equipment was supplied by the Otis Elevator Company.

## MOTOR-DRIVEN FIRE PUMP.

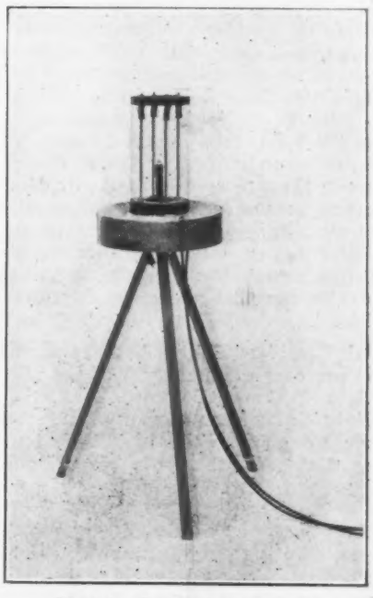
The Westinghouse underwriters' motor, illustrated herewith, is designed in accordance with all specifications of the Chicago Local Board of Fire Underwriters. All joints in the frame are waterproof, and the leads are brought out above the center line so that water can rise to that depth

Motor-Driven Fire Pump.

without affecting the operation of the motor. The air outlet can be fitted with a down-turning pipe, thus preventing falling water from entering the frame. Effective ventilation is obtained by an external blower mounted on the shaft extension. Excellent commutation is insured by the use of commutating poles. The speed can be increased 10 per cent by shunt-field control. It is made in sizes of 50 hp, 75 hp and 100 hp with a speed of 1400 r.p.m., and 150 hp at 1200 r.p.m., for 220 volts and 500 volts.

## ELECTRIC SCREENS AND INSECT DESTROYERS.

The secondary circuit of a spark coil is used to kill insects by means of electric house screens, orchard protectors and insect exterminators made by the Interstate Manufacturing Company, Spokane, Wash. The illustra-



Electric Orchard Protector.

tion shows the orchard protector, designed for cotton fields, tobacco plantations and orchards. The small incandescent lamp in the center attracts the insects, which are killed by contact with the oppositely charged wires making up the cylinder. The exterminator for garden use is identical in principle. The spark-coil is operated by storage battery or may be connected to a 6-volt bell-ringing transformer.

# Industrial and Financial News

STATEMENTS made this week by railroad officials upon their return from the harvesting sections indicate that the movement of this year's crops will be a most severe tax upon transportation facilities. Estimates of car shortage are numerous, some of these placing the amount as high as 200,000. Some scarcity of labor is reported in the agricultural and in several of the manufacturing districts. Purchasing in anticipation of autumn requirements is furnishing impetus to the trade movement that has been gathering headway since the crop outlook became so favorable. Collections are improving and money is taking on a firmer tone. Large demand for electrical equipment is shown in advices that the unfilled orders on the books of the General Electric Company are the largest in the history of the company, and in the fact that the plants of the Westinghouse Electric & Manufacturing Company are running at full capacity. The local jobbers and dealers regard the outlook as favorable. While prices are not as high as desired, they expect to enjoy a better business this year than was the case in 1911. In the insulated wire trade demand is on an encouraging scale. While no pronounced change has taken place this week in the copper market, higher prices are expected.

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**Cost of Gas and Electric Service Compared with "Cost of Living."**—An investigation made by C. D. Parker & Company, bankers, of Boston, Mass., into the variations in the prices for gas and electric service, the amounts paid in dividends by gas and electric companies in the State of Massachusetts and the "cost of living" in that State during the years 1904-1911, inclusive, reveals a very creditable record in favor of the public-utility companies. The data upon the public-utility companies were based on the reports of the Massachusetts Board of Gas and Electric Light Commissioners, and the figures for the cost of living were founded upon prices for household commodities in market reports. Taking prices and the amount paid in dividends in 1904 as a base, the per cent of increase or decrease in prices and amounts paid in dividends as ordinates and the years 1904-1911 as abscissas, three curves were plotted. During the seven years mentioned, according to these curves, the cost of living increased 37 per cent, the prices of gas and electricity were reduced nearly 17 per cent, while the amounts paid in dividends by gas and electric companies in the State increased over 112 per cent, as compared with these items in 1904. The greatest variance, the increase of more than 112 per cent in dividends during a period when the prices of gas and electric service decreased nearly 17 per cent, is a significant indication of the ability of many public-utility companies to increase their returns and reduce prices simultaneously, this method insuring the holding of present business and attracting further increase in connected load.

**Progress of Brazilian Public Utilities Consolidation.**—More than 60 per cent of the shares of the Rio de Janeiro Tramway, Light & Power Company, Ltd., the Sao Paulo Tramway, Light & Power Company, Ltd., and the Sao Paulo Electric Company, Ltd., of Brazil, have been deposited under the agreement for a consolidation of these companies into the new $120,000,000 corporation to be known as the Brazilian Traction, Light & Power Company, Ltd. This is the statement of Sir William MacKenzie, of Toronto, who is to be chairman of the board of the new company, as was stated in these columns June 29, when details of the proposed merger, including the tentative board of directors, officers and capitalization of the new company, were given. While no specific number of shares necessary for ratification of the agreement is mentioned, Sir William MacKenzie states that a substantial majority must be deposited to effect consummation of the plan. Although the board has not met as yet to pass upon the matter, he feels certain that the shares already deposited, with those understood to be coming in, will be sufficient to assure the carrying out of the project.

**Westinghouse Electric's Showing.**—The plants of the Westinghouse Electric & Manufacturing Company are working at full capacity, and from present indications the volume of business that will be handled by the company this year will reach record proportions. Attention has been called recently to the improved status of the company during the past four years under the new management, due to the policy of turning all surplus earnings into betterments. The working capital of the company has increased in the past four years from $19,339,000 to over $29,000,000. Four years ago the company had $28,361,000 of quick assets and $9,022,000 of current liabilities, while at present the quick assets are placed at $32,830,847 and the current liabilities at $3,047,874. Owing to the improved financial condition of the company it has been expected that some form of extra distribution to common stockholders will be made shortly. As was noted in these columns Aug. 10, it is thought that the directors will declare dividends at the rate of at least 6 per cent per annum on the common stock at their meeting in September.

**Prest-O-Lite Owners Buy Interest in Esterline Company.**—Carl Fischer and James G. Allison, owners of the Prest-O-Lite Company and the Indianapolis Motor Speedway, have purchased one-half of the $250,000 capital stock of the Esterline Company, of Lafayette, Ind., which manufactures electrical specialties, including graphic registering meters and the Berdon electric-lighting system for motor vehicles. The plant of the Esterline Company will be moved to new quarters near the Indianapolis Motor Speedway. Orders for the Berdon lighting equipment aggregating more than $1,000,000 have been booked by the Esterline Company. The latter has been conducting tests for more than a year upon a combined electric starting and lighting equipment for motor cars. A new electric lamp said to have great fog-piercing qualities which the company has developed for use on motor cars will be one of the most important lines which it will manufacture.

**Acquires Control of Arizona Utility.**—The Arizona Power Company, of Prescott, Ariz., of which F. S. Viele, of Viele, Blackwell & Buck, consulting engineers, 49 Wall Street, New York, is president, has taken over the control of the Pacific Gas & Electric Company, of Phoenix, Ariz. This company, in addition to operating a steam plant, buys surplus energy generated at the station at the Roosevelt Dam, 65 miles from Phoenix, and distributes it to about 2200 customers in that city and adjacent territory. Its authorized capitalization is $600,000 in common stock and $400,000 in 5 per cent cumulative preferred stock. All of the latter and $363,500 of the common is outstanding as well as $525,000 5 per cent bonds. In addition to its electric business the company supplies gas to nearly 1600 customers. It is probable that the company's steam station will now be used only as a reserve.

**General Electric's Business at Record Level.**—Unfilled orders on the books of the General Electric Company at this time are understood to be larger than at any previous period in the history of the company. Production of lamps is running at a rate of more than 1,000,000 per week, and owing to the wide demand, it will probably be necessary to increase this weekly output by over 100,000 lamps. There are now some 5500 employees at the Harrison, (N. J.) Lamp Works, and about 1200 will be employed at the new lamp factory at East Boston, which will enable the company to meet such surplus demands for lamps as cannot be filled by the present factories. The company has recently closed contracts for about 20,000 tons of pig iron, the bulk of which will be used in its Schenectady plant.

**Yarrow & Company, Scotland, to Make Terry Turbines.**—The Terry Steam Turbine Company, Hartford, Conn., has given Yarrow & Company, Ltd., Glasgow, Scotland, exclusive rights to manufacture Terry turbines for forced-draft work in Great Britain.

**Plant Extension at Mobile.**—To meet the increasing electrical demands of the city the Mobile (Ala.) Electric Company will install a new 3000-kw turbo-generator.

**Incorporate Kentucky Utilities Company.**—The Kentucky Utilities Company, capitalized at $2,000,000, has been incorporated in Louisville, Ky., by Charles J. Ruebling, L. E. Powell and W. R. Watson, all of Chicago, the last named being secretary of the Corporation Trust Company of that city. The charter of the new company empowers it to construct and operate electric plants and natural and artificial gas plants, to sell the products of such plants, to conduct and maintain all lines of work connected with street railways and ice plants, to manufacture and sell machinery for public-utility plants and to mine coal. According to advices emanating from Louisville, there is a belief in that city that H. M. Byllesby & Company, who are interested in Kentucky public-service companies, are affiliated with the new concern. Engineers of the Byllesby company have been making a preliminary investigation of the operating conditions of the Louisville Railway Company, with a view to obtaining data upon which to estimate the cost of supplying energy from the mains of the Louisville Lighting Company, owned by the Byllesby interests, to the traction company. A reference to this movement for supplying energy to the traction company appeared in these columns Aug. 3. There have been rumors in Louisville that the Byllesby company will shortly make an offer for the stock of the Louisville Railway Company, but no formal announcement of such offer has been made.

**Merger of Rhode Island Utilities.**—Formal merger of the four principal public utilities in the Woonsocket and Pawtucket districts of Rhode Island into the Blackstone Valley Gas & Electric Company will take place about the middle of September. These companies are controlled by the Stone & Webster interests, and the merger with the Blackstone company has been made in order to centralize the financing and management of them. As was noted in these columns March 30, 1912, in an account of the bill which was filed in the Rhode Island Legislature to effect this consolidation, the companies to be merged are the Woonsocket Electric Machine & Power Company, the Woonsocket Gas Company, the Pawtucket Electric Company and the Pawtucket Gas Company. The bill was passed at the last session of the Legislature and sanctioned the sale of the companies to the Blackstone Valley Gas & Electric Company, incorporated under Maine laws by the Stone & Webster interests. Stockholders of the four companies will meet on Sept. 16 to ratify the actions of their boards of directors relative to participating in the merger.

**Standard Underground Cable Company's Business Increasing.**—The new plant of the Standard Underground Cable Company at Hamilton, Ont., is rapidly nearly completion, and it is understood that it will be in operation at full capacity by January, 1913. Joseph W. Marsh, vice-president of the Standard Underground Cable Company, was quoted this week upon the company's business as follows: "Our new plant at Hamilton will be ready by Jan. 1, and it looks as if it would be run to full capacity at once. We are not as yet planning any further extensions, but business is very good, and there is no indication that it will not continue to increase. We had a good year last year, doing a business of about $12,000,000, and did not look for the good fortune we have realized in what usually would have been a year of pessimism, owing to politics. Our business this year will be between $14,000,000 and $15,000,000. So far as I can see there is no reason for apprehension for the future."

**Expect Increase in Earnings of Pacific Gas & Electric.**—Estimates of earnings of the Pacific Gas & Electric Company for the full twelve months of 1912, based upon those in the first six months in the year, lead to the belief that a gain of nearly $1,000,000 in gross earnings will be made in 1912. Gross revenue of the company last year was $14,604,609, which was an increase of $305,381 over the returns in 1910. There were 299,350 customers on the books of the company on June 30, 1912, which means an increase of 12,244 consumers in the first half of this year. It is said that the gain for the entire year will probably reach nearly 25,000, so that with the revenue from these new sources and with the increase expected from the older customers the estimates of larger gross business noted above seem justified. Work on the company's new hydroelectric plants on Bear River is going forward at a satisfactory rate, and it is expected that they will be placed in operation during the coming year.

**Pennsylvania Companies Consolidate.**—A merger of six electric companies in the northern and central parts of Pennsylvania into the Central Pennsylvania Electric Company, of Lock Haven, capitalized at $30,000, has been approved by Governor Tener of that State. The companies named in the merger are the West Branch Light, Heat & Power, Williamsport; Susquehanna Light, Heat & Power, Jersey Shore; Logan Electric Company, Bellefonte; Avis Light, Heat & Power Company, Avis, and Patterson, Scootac & Clinton Light, Heat & Power Company, of Lock Haven. H. B. Waltman, S. A. Greer and James J. Geery, of York, have been granted charters for four electric companies in York County. Each of these companies will have a capital of $5,000 and will have offices in York. They will operate in the townships of Dover, Manchester and East and West Manchester, and each corporation will bear the name of the township in which it operates.

**Capitalization of Northern Indiana Utilities Company.**—It is reported that the newly organized Northern Indiana Utilities Company, mentioned in the *Electrical World* of Aug. 24, has an initial capital of $1,075,000, and that it has the following-named officers: President, Samuel Insull; vice-presidents, C. A. Munroe and T. H. Munroe; secretary and treasurer, A. S. Scott. C. A. Munroe, who is one of the vice-presidents of the Public Service Company of Northern Illinois, is credited with conducting the negotiations which resulted in the acquisition of electric-service properties in Monticello, Wolcott, Earl Park, Fowler and Kentland, Ind. There is a hydroelectric plant at Monticello, and it is probable that a transmission line will be built from that place to Kentland. At the present time the Northern Indiana Utilities Company is not a subsidiary organization of the Middle West Utilities Company.

**Working on Northwestern Electric Company's Plant.**—Advices from California state that the Northwestern Electric Company, backed by San Francisco and Paris bankers, will be ready to deliver energy from its 20,000-hp plant on Salmon River, near Portland, by Jan. 1, 1913, and that, while not intending to enter the electric-railway field itself, the company will encourage electric-railway building by offering electric energy at a very low price. The company has water rights on the Salmon, Klickitat and Lewis Rivers of sufficient capacity to generate a total of 100,000 hp.

**Good Prospects for Motor-Service Loads in Ohio.**—Owing to the prosperous condition of the iron and steel business in the Mahoning Valley at this time, the prospects for supplying energy to these industries from the plant of the Republic Railway & Light Company, under construction at Lowellsville, Ohio, are said to be very bright. Description of this plant, which is being built by the Stone & Webster Engineering Company and is to contain two 9375-kva turbine units, appeared in these columns June 1.

**Southern California Utilities Financing.**—A European syndicate has underwritten the bond issues of the Southern California Utilities, a corporation recently organized to consolidate a number of public utilities in Southern California, as was noted in these columns June 29. The underwriting of the bonds is contingent upon approval of their issue by the California Railroad Commission. The corporation has $10,000,000 twenty-five-year 5 per cent bonds and $1,000,000 in stock.

**Ottawa (Can.) Consolidation Plan Abandoned.**—Announcement has been made that the plan that had been made for a merger of the Ottawa Street Railway Company, the Ottawa Gas Company, the Ottawa Electric Company and the Ottawa Car Company, of which previous mention was made in these columns, has been abandoned. Although the same interests are identified with all four properties, it was decided by stockholders that separate maintenance organizations would be more desirable.

**Roanoke (Va.) Traction & Light Earnings.**—Earnings and expenses of the Roanoke (Va.) Traction & Light Company for the year ended June 30, 1912, were as follows: Gross, $509,550; operating expenses and taxes, $281,689; net earnings, $227,861; interest charges, $101,470; net income, $126,391; sinking fund, $11,226, and surplus, $115,165.

**Scranton (Pa.) Electric Company's Bonds.**—Among the public utility securities offered for sale this week are $234,000 of the 5 per cent gold refunding bonds of the Scranton (Pa.) Electric Company, which is a consolidation of several companies, controlling the entire electric light and power business of Scranton and nearby towns, and is, in turn, controlled by the American Gas & Electric Company. The bonds are dated July 1, 1907, and are due in 1937, but are redeemable on any interest date after 1912 at 110 and accrued interest. The company serves a growing population which numbers about 225,000 at the present time. The bonds are secured by a first mortgage on the entire property of the company, subject to a prior lien of but $21,000, which represents outstanding bonds of the constituent companies. An annual sinking fund of 2 per cent of the total amount of the bonds is provided for by the mortgage. The officers of the company are: President, R. E. Breed; vice-president, George N. Tidd; secretary and treasurer, F. B. Ball, all of 30 Church Street, New York. The offering is being made by Harris, Forbes & Company.

**Authorize General Electric Stock Increase.**—At a meeting in Schenectady on Aug. 29, the stockholders of the General Electric Company voted to increase the capital stock of the company from $80,000,000 to $105,000,000, in accordance with plans of the company, to which reference was made in these columns July 27, to pay, after such increase to stockholders of record of Dec. 31, 1912, out of the surplus, a dividend of $30 a share, payable in the stock of the company at par.

**Cleveland Electric Illuminating Company to Build Substation.**—A new substation to be used in connection with furnishing service in the downtown district of Cleveland is to be built by the Cleveland Electric Illuminating Company. The latter has applied to the Ohio Public Service Commission for authority to issue bonds to the amount of $207,138. The proceeds are to be applied to meeting the cost of property recently acquired by the company.

**Additional Equipment for Commonwealth Edison Company.**—The Commonwealth Edison Company of Chicago has recently ordered from the Westinghouse Electric & Manufacturing Company two 4000-kw, 600-volt, six-phase, 25-cycle rotary converters and two 4400-kva, three-phase, 25-cycle, 9000-volt to rotary-voltage air-blast transformers complete with reactance coils and blower sets; also one nineteen-panel marble switchboard.

**Lithographing Company Will Use Central-Station Service.**—The Republic Bank Note Company, of Pittsburgh, has decided to do away with the use of steam power and will operate its new works, now building, entirely by central-station service. It has purchased 265 ft. of land fronting on Thackeray Avenue, Pittsburgh, upon which it is erecting a factory building that will have about six times the floor space of its present plant.

## REPORTS OF EARNINGS

KINGS COUNTY (N. Y.) ELECTRIC LIGHT & POWER COMPANY AND EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN.

The combined statements of earnings of the Kings County Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn for the seven months ended July 31, 1912 and 1911, compare as follows:

| Jan. 1 to July 31. | 1212. | | 1911. |
|---|---|---|---|
| Gross operating revenue | $2,990,075.68 | | $2,665,992.12 |
| Operating expenses excepting taxes and depreciation charges | $1,247,227.87 | $1,126,466.06 | |
| Taxes | 240,500.00 | 227,500.00 | |
| Depreciation charges | 410,369.41 | 321,751.45 | |
| Total operating expenses | 1,898,097.28 | | 1,675,717.51 |
| Net operating revenues | $1,091,978.40 | | $990,274.61 |
| Non-operating revenues | 27,749.95 | | 37,638.47 |
| | $1,119,728.35 | | $1,027,913.08 |
| Bond discount written off | 11,823.49 | | 11,823.49 |
| | $1,107,904.86 | | $1,016,089.59 |
| Fixed charges — bond interest | 493,826.67 | | 455,601.25 |
| Profit and loss surplus for the seven months | $614,078.19 | | $560,488.34 |

AMERICAN LIGHT AND TRACTION COMPANY.

Earnings of the American Light & Traction Company for July, the seven months and the twelve months ended July 31, 1912, compare with those for the corresponding periods of 1911 as follows:

| | 1912. | 1911. |
|---|---|---|
| July, gross | $299,729 | $284,892 |
| July, net | 288,612 | 275,255 |
| Seven months, gross | 2,278,946 | 2,295,203 |
| Seven months, net | 2,206,418 | 2,229,620 |
| Twelve months, gross | 4,127,796 | 4,077,000 |
| Twelve months, net | 4,007,040 | 3,960,075 |

Expenses in July, 1912, were 15.36 per cent greater than in July, 1911.

## PRICES IN NEW YORK METAL MARKET.

| Copper: | Aug. 20 Bid. | Aug. 20 Asked. | Aug. 27 Bid. | Aug. 27 Asked. |
|---|---|---|---|---|
| Standard: | | | | |
| Spot | 17.25 | 17.50 | 17.25 | 17.50 |
| August | 17.25 | 17.50 | 17.25 | 17.50 |
| September | 17.37½ | 17.50 | 17.25 | 17.50 |
| October | 17.30 | 17.50 | 17.25 | 17.50 |
| London quotation: | £ s d | | £ s d | |
| Standard copper, spot | 78 17 6 | | 79 15 0 | |
| Standard copper, futures | 78 17 6 | | 79 17 6 | |
| Prime Lake | 17.60 to 17.70 | | 17.65 to 17.70 | |
| Electrolytic | 17.60 to 17.65 | | 17.60 to 17.70 | |
| Casting | 17.35 to 17.45 | | 17.40 | |
| Copper wire, base | 19 00 | | 19.00 | |
| Lead | 4.50 | | 4.65 | |
| Sheet zinc, f.o.b. smelter | 8.75 | | 8.75 | |
| Spelter, spot | .... | | 7.20 | |
| Nickel | 40.00 to 41.00 | | 40.00 to 41.00 | |
| Aluminum: | | | | |
| No. 1 pure ingot | 21½ to 22½ | | 21½ to 22½ | |
| Rods and wire, base | 32 | | 32 | |
| Sheets, base | 33½ | | 33½ | |

OLD METALS.

| | | |
|---|---|---|
| Heavy copper and wire | 15.50 | 15.75 |
| Brass, heavy | 10.00 | 10.00 |
| Brass, light | 8.00 | 8.25 |
| Lead, heavy | .... | 4.40 |
| Zinc, scrap | 5.75 | 5.75 |

## COPPER EXPORTS IN AUGUST.

Total tons, including.....Aug. 20, 14,738 Aug. 27, 22,801

## STOCK MARKET PRICES.

| | Aug. 21. | Aug. 28. |
|---|---|---|
| Allis-Chalmers | ¼* | ¼* |
| Allis-Chalmers, pf | 2½* | 1⅜ |
| Amalgamated Copper | 87½ | 87⅜ |
| Amer. Te. & Tel | 146 | 144⅞ |
| Boston Edison | 291* | 291* |
| Commonwealth Edison | 139* | 139 |
| Electric Storage Battery | 57¼ | 57 |
| General Electric | 183 | 182¼ |
| Mackay Companies | 87* | 87¾ |
| Mackay Companies, pf | 69* | 69½ |
| Philadelphia Electric | 23⅝ | 23⅜ |
| Western Union | 83 | 82¼ |
| Westinghouse | 88 | 87 |
| Westinghouse, pf | 125 | 125 |

*Last price quoted.

# Personal

**Mr. A. G. Langenbach** has resigned as superintendent of the Boulder Electric Light & Power Company to take up ranch life in Wyoming.

**Dr. Charles K. Raber,** president of the Rocky Ford Milling and Power Company, which furnishes electrical energy for Manhattan, Kan., has been elected Mayor of Junction City, Kan.

**Mr. William B. Whitehorn,** purchasing agent of the Omaha Electric Light & Power Company, Omaha, Neb., has been appointed assistant to President F. A. Nash of that company.

**Mr. E. M. Walker,** general manager of the Citizens' Railway & Light Company, Muscatine, Ia., has been appointed general manager of the Union Electric Company, Dubuque, Ia., effective Sept. 1.

**Mr. A. R. Doble,** secretary and treasurer of the Western Canada Power Company, Vancouver, British Columbia, has been elected president of the Royal Securities Company, of Montreal, Can., to succeed Sir Max Aitken.

**Mr. Edgar K. James,** formerly manager of the appliance bureau of the United Electric Light & Power Company, New York City, has resigned and will represent the "Universal" appliances made in New Britain, Conn.

**Mr. J. C. Nelson,** formerly general superintendent for the Western Union Telegraph Company at Denver, has been

promoted to the position of assistant to Mr. Belvidere Brooks, general manager of the same company, with headquarters in New York.

**Mr. W. L. Greenleaf** has resigned his position as engineer of the Hollingsworth & Vose Paper Company, East Walpole, Mass., and accepted the position of superintendent of the Vineyard Haven Railway, Gas & Electric Company, Vineyard Haven, Mass.

**Mr. T. W. Carroll,** of New York, has been appointed division traffic superintendent of the Western Union Telegraph Company in Chicago, succeeding Mr. W. J. Lloyd. Mr. Carroll is a telegraph executive of wide experience and is considered one of the best traffic men in the service.

**Mr. H. E. M. Kensit,** for the past four years engaged in investigating and reporting on various projects in Canada and the United States for the firm of Smith, Kerry & Chase, of Toronto, has received an appointment with the Water Power Branch of the Canadian Department of the Interior, at Ottawa, Ont.

**Mr. H. L. Patterson,** for many years general superintendent of the lighting and power department of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, and later mechanical engineer of the company, has severed his connection with the utility in order to become manager of the Pennsylvania China Company in Kittaning and Ford City, Pa.

**Mr. C. C. Brown** has been appointed superintendent of the Northern Colorado Power Company's station in Boulder, Col., succeeding Mr. A. G. Langenbach, resigned. Mr. Brown has been connected with the company for over ten years, and, by close application to his duties and loyalty to his employers, has worked his way up from motorman to street-car superintendent and now to local manager.

**Miss Mary Gray Marston,** domestic science expert and specialist in electric appliances, who has done much interesting work in this line and in lecturing, having been associated with the United Electric Light & Power Company, Springfield, and the Boston Edison company, is to replace Mr. Edgar K. James as manager of the appliance bureau of the United Electric Light & Power Company, New York City.

**Mr. George L. Erwin,** president of the Grand Rapids Edison Company and manager of the Grand Rapids-Muskegon Power Company, Grand Rapids, Mich., has become associated with the Michigan United Traction Company, with headquarters at Kalamazoo. The long-projected interurban railway from Grand Rapids to Kalamazoo will early occupy Mr. Erwin's attention. Another project being considered is an electric belt line between Grand Rapids, Kalamazoo and Battle Creek to handle freight traffic, the plans for which will be in Mr. Erwin's hands.

**Mr. W. F. Wells** has been appointed acting general manager of the Edison Electric Illuminating Company of Brooklyn, relieving Mr. W. W. Freeman of many of his duties. As previously announced, Mr. Freeman has been appointed a director and officer of the Alabama Interstate Power Company, which will operate several electrical properties in the South. While Mr. Freeman will retain his official relations with the Brooklyn properties until at least the end of the year, he will devote a large part of his time to the Alabama Interstate Power Company, hence the assumption of many of his duties by Mr. Wells.

**Mr. A. C. King** has been employed as an assistant to Mr. Ray Palmer, city electrician of Chicago, under the authority of the committee on gas, oil and electric light of the City Council. Mr. Palmer is giving a good deal of his time at present to the committee's investigation of the rate schedules of the Commonwealth Edison Company. Mr. King has been retained to assist the city electrician during the period of his investigation. Mr. King is an engineering graduate of the University of Wisconsin, class of 1901, and some years ago was assistant to the chief engineer of the Northern Electric Manufacturing Company, of Madison, Wis.

**Mr. William J. Lloyd,** of Chicago, formerly division traffic superintendent of the Western Union Telegraph Company, has been advanced to the position of general superintendent of the mountain division of the same company, with headquarters in Denver. The appointment will be effective on Sept. 1. Mr. Lloyd has been engaged in the telegraph service in Chicago since 1877. Beginning as a messenger boy in Dubuque, he has been successively operator, wire chief of the Chicago office, night chief, manager of the Board of Trade office, chief operator of the Chicago office, assistant district superintendent, district superintendent, division traffic superintendent and now general superintendent. Mr. Lloyd has made several improvements in the service and has been called on often to do special work at national political conventions. He is very well known to the prominent newspaper correspondents of the country. Mr. Lloyd is a former president of the Old Time Telegraphers' and Historical Association and is a member of the Union League Club of Chicago. From his new office in Denver he will supervise the Western Union service in eight states.

## Obituary

**Mr. Edward H. Ball,** vice-president of the Chicago Belting Company, died at his home in Evanston, Ill., on Aug. 23, aged fifty-five years. Mr. Ball graduated from Princeton University and was said to have been a classmate of Gov. Woodrow Wilson. He was one of the founders of the company with which he was connected.

**Mr. Christopher C. Wilson,** formerly president of the United Wireless Telegraph Company, died on Aug. 25 in the United States penitentiary at Atlanta, Ga., where he was serving a three-year sentence for using the mails in an attempt to defraud. He was sixty-seven years of age and had become prominent through the sensational collapse of the company and subsequent proceedings to ascertain the disposal of the company's funds.

**Mr. Harold Gay,** who had been employed by L. B. Stillwell in important engineering work, died suddenly on Aug. 25 at Farmington, Conn. Prior to his association with Mr. Stillwell he had been in the engineering department of the General Electric Company and in charge of some of that company's important electrical construction work. For some years he was in the electrical department of the United States Navy, during most of which time he was stationed at Manila. After joining Mr. Stillwell's organization he had charge of the testing of all apparatus purchased and other important engineering work. Mr. Gay acted as supervising engineer in the construction of the power house at North Adams, which supplies the energy for the operation of the Hoosac Tunnel electric zone. He was also actively engaged in preparing engineering estimates and calculations for important steam and hydroelectric developments. In work of this nature he showed unusual ability. Mr. Gay possesed a very attractive personality and, although modest and retiring, he was a general favorite among his associates. He was a man of unusually high character, and his loss is keenly felt by his friends and business associates.

**Mr. Clift Wise,** who for many years was prominently identified with the construction of street and interurban railways, and who was well known to electrical men of the Middle West, died in Springfield, Ohio, on Aug. 26. Mr. Wise was born in St. Louis in 1861. In 1886 and 1887 he was chief engineer of the Kansas City Street Railway Company and built the cable railways of that city. Later he went to Minneapolis and St. Paul and reconstructed the street railways in those cities. Thereafter he was engineer in charge of the laying of the cable railways in Philaphia. About 1892 he came to Chicago and for several years engaged in electrifying the lines of the Chicago City Railway Company. Later he embarked in the contracting business and built electric interurban railways between LaSalle and Peru, Ill.; Danville and Champaign, Ill.; Crawfordsville and Lebanon, Ind.; Springfield and Troy, Ohio, and Portland and Marion, Ind. He also constructed a large storage reservoir for the city of Lima, Ohio. About seven years ago he left the electric railway field and engaged in the construction of large industrial establishments. Mr. Wise is survived by a widow and a married daughter. He was a member of the Kenwood Club and the Union League Club of Chicago, and of the Lagonda Club and Springfield Commercial Club of Springfield, Ohio.

# Construction

MOBILE, ALA.—The Mobile El. Co. is planning to install additional equipment which will double the present output of the plant. Orders have been placed for a 3000-kw generator. The cost of the improvements is estimated at about $85,000. T. K. Jackson is president and manager.

MONTGOMERY, ALA.—The bill giving the Alabama Pwr. Co. the right to build a dam across the Coosa River, 7 miles above Wetumpka, Ala., has been vetoed by President Taft.

PHOENIX, ARIZ.—The Phoenix Ry. Co. has been ordered to reconstruct its street and interurban railway systems in Maricopa. The work includes new cars, signals, switches, roadbed, rails, poles and overhead construction.

PHOENIX, ARIZ.—The Salt River Valley Water Users' Association has approved the contract whereby the Inspiration and Miami Copper companies, of Miami, will secure electricity generated at the power plant at the Roosevelt dam to the amount of 11,000 kw. The companies will erect their own transmission lines, 30 miles long.

LITTLE ROCK, ARK.—The City Council is considering the question of placing all electric and telephone wires underground in the business district.

BURBANK, CAL.—The Burbank El. Lt. & Pwr. Co. has filed application with the State Railroad Commission for authority to take over the electric light and power franchise granted to G. H. Deacon by the town of Burbank. The company is capitalized at $20,000.

BURLINGAME, CAL.—Ansel M. Easton, of Easton, who holds a franchise for a street railway through the town of Easton, in the northern district of Burlingame, is contemplating the construction of a street-railway system in Burlingame and is planning to secure other franchises in the central and western districts of the city.

GALT, CAL.—The Board of Supervisors has adopted a resolution calling for an election to vote on the formation of a street-lighting district.

GLENDALE, CAL.—An agreement has been signed by the officials of the city of Glendale and the Public Service Commission of Los Angeles whereby the city of Glendale will secure electricity generated by the Owen River Aqueduct power plant from April 1, 1913, and to July 1, 1917, at a cost of $69,378, which includes interest, depreciation and maintenance of 6 miles of 30,000-volt transmission line. The cost of the line is estimated at $6,000.

GREENVILLE, CAL.—The Greenville Bullion Mining Co. is planning to erect an electric hoist on its bullion mine.

LOS ANGELES, CAL.—Plans are being considered for lighting the entire San Gabriel Valley, extending from Azusa and Glendora in the foothill region to the beginning of the Mount Wilson trail, and around to Whittier and the coast, by the San Gabriel Intercity Commission of which John D. Reavis, of South Pasadena, is president. The scheme involves paved highways in 24 cities and towns and illuminating more than 100 miles of highways. It is proposed to use electroliers.

MARYSVILLE, CAL.—Arrangements are being made by the Pacific Gas & El. Co. for the erection of a transmission line from Nicolaus across the Feather River and the Sutter tule basin to Kirksville.

NEWPORT BEACH, CAL.—At an election to be held Sept. 10 the proposition to issue bonds for the installation of a municipal electric-light plant will be submitted to a vote.

OXNARD, CAL.—Preparations are being made for the installation of a municipal electric-light plant, bids for construction of which will be called for at once. Negotiations are under way between the City Trustees and the officials of the Ventura County Pwr. Co. for the purchase of the old plant of the company before erecting a new plant.

PORTERVILLE, CAL.—It is reported that the Porterville Northeastern Railroad will be equipped for electrical operation within 18 months. It is expected that the proposed railroad from Porterville to the Woodville district will also be electrically operated.

RANDSBURG, CAL.—The Consolidated Mines Co. is planning to install an electrically operated pump on its Kenyon Wedge property.

SAN FRANCISCO, CAL.—Surveys are being made by the Great Western Pwr. Co. for the erection of a new high-tension transmission line from Oroville to Napa, a distance of about 95 miles.

TROPICO, CAL.—The Pacific Lt. & Pwr. Co., Los Angeles, has applied to the State Railroad Commission for permission to purchase the tangible properties of the Glendale Lt. & Pwr. Co., consisting of equipment used to furnish electricity for lamps and motors in Tropico.

TULARE, CAL.—Sealed bids will be received by the city clerk until Sept. 3 for sale of a franchise applied for by the Big Four El. Ry. Co. to construct and operate an electric railway in the town of Tulare.

WATSONVILLE, CAL.—Plans are being considered by the Watsonville Ry. & Navigation Co. for extending its railway to Hollister, and later to Fresno via Firebaugh or Los Banos. F. E. Snowden, 311 California Street, San Francisco, is president and general manager of the company.

BOULDER, COL.—A committee has been appointed by the City Council to prepare plans for the proposed municipal electric-light plant. Specifications have been prepared by the city engineer, and the committee is authorized to employ other engineers for consultation to get plans in shape to advertise for bids. The plans provide for the construction of a power house on Boulder Creek 5 miles west of Boulder, a substation in the city, a reservoir in the hills and a transmission line from the power house to the city. The cost of the work is estimated at about $90,000. A bond issue of $35,000 has been authorized and a proposal for another issue for the balance will probably be submitted to vote at the next city election.

THOMASTON, CONN.—The plant of the Thomaston El. Lt. Co., it is reported, will be leased to the Connecticut Co., New Haven. The latter company has purchased the power plant at Falls Village and will eventually supply Thomaston with electrical service from that plant. The local plant will be held in reserve for use in emergencies.

WASHINGTON, D. C.—Sealed bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 3 for transformers as per Schedule 4762. Applications for proposals should designate the schedule desired by number.

OKEECHOBEE, FLA.—The establishment of an electric and ice plant here is under consideration. Austin & Rice, of Jensen, are interested.

NAMPA, IDAHO.—Preparations are being made by C. M. Talmadge, of New York, for the construction of a power plant on the Canyon Canal, to develop 10,000 hp. Electricity generated at the plant will be used to operate pumping plants for irrigating purposes in that vicinity and near Weiser.

WENDELL, IDAHO.—Plans are being considered by J. W. Crawley, of the Crawley-Salisbury Constr. Co., of Davenport, Ia., and J. Stewart Clark, of Buffalo, N. Y., for the construction of an electric line between Wendell and Hagerman, a distance of 15 miles.

ALTON, ILL.—The Piasa Lt. & Pwr. Co., it is reported, contemplates the erection of a transmission line from Alton to Elsah, Piasa, Chautauqua and Grafton and will seek franchises to supply electricity in those places.

ARCOLA, ILL.—The local electric-light plant and ice factory, owned by George C. Hallauer, has been purchased by Marshall E. Sampsell, representing the Central Illinois Public Service Co., for $35,000. Mr. Hallauer was recently granted a 50-year electric franchise in Arcola, in return for which he agrees to erect ornamental lamp standards to cost $1,000, and to furnish electricity to maintain same during the life of franchise free of charge; also to supply electricity for lighting all public buildings free of charge until the expiration of the franchise. A 24-hour service is also to be established. The new company will discard the local plant and will supply electric energy to operate the system from its high-tension transmission system.

CANTON, ILL.—The City Council has instructed the lighting committee to secure data regarding the cost of installing a municipal electric-light plant.

CARROLLTON, ILL.—The property of the Carrollton Ht., Lt. & Pwr. Co. has been taken over by the Northern Illinois Utilities Co.

CUBA, ILL.—The municipal electric-light plant has been purchased by Bass & Anderson, of Farmington.

ELGIN, ILL.—Plans are being considered for the installation of ornamental lamps on the business streets on the west side of the river. E. D. Howell, secretary of the Commercial Club, has asked to have maps of the business streets prepared for this purpose.

IPAVA, ILL.—Negotiations are under way between the owners of the local electric-light plant and the Bushnell Pwr. & Lt. Co., Bushnell, whereby the latter will take over the distributing system of the local plant. The new company proposes to furnish a 24-hour service and will also furnish electricity to the farmers along the transmission line between here and Bushnell.

MOLINE, ILL.—The Tri-City Ry. Co. has applied to the City Commission for a franchise on several streets of the city.

NEOGA, ILL.—The Central Illinois Pub. Ser. Co. is securing right-of-way for a transmission line from Mattoon to Neoga.

PEORIA, ILL.—The Park Board has decided to erect 17 ornamental lamps on Riverside Drive.

RAMSEY, ILL.—Application has been made by F. S. Peabody to the City Council for a 50-year franchise to operate an electric-light plant here.

RANKIN, ILL.—Application has been made to the Village Board by H. L. Clark and Edwin Johnson for permission to extend their transmission lines from Paxton to Rankin.

RUSHVILLE, ILL.—The City Council has entered into a contract with the Middle West Utility Co. whereby the latter will furnish to the city electricity delivered at the city limits at 5 cents per kw-hr. The company also agrees to furnish energy for a 30-hp and a 20-hp motor.

SANDWICH, ILL.—The City Council has granted the Aurora, Mendota & Western Ry. Co. a franchise to build and operate an interurban railway on Church Street.

SULLIVAN, ILL.—The Sullivan El. Co. is rebuilding its plant, changing to 60-cycle, three-phase system and erecting a transmission line to Arthur, to supply electricity for lamps and motors there. Charles Kuster is secretary and manager.

AVILLA, IND.—The Village Board has accepted the proposition submitted by the Olds Constr. Co., of Fort Wayne, for the installation of an electric-light plant in Avilla, to cost about $5,500. Electricity will be purchased for operating the system.

LAFAYETTE, IND.—Preparations are being made by the Indiana Ltg. Co. to extend its transmission lines to the town of Otterbein to supply electrical service there.

MADISON, IND.—The Madison Ry. & Lt. Co. is planning to erect a transmission line to Hanover and possibly to Cyrus Ridge. Cluster lamps will also be installed on the principal streets in Madison. M. F. Tennis, Vandergrift Building, Pittsburgh, Pa., is treasurer and manager.

NORTH VERNON, IND.—Plans are being considered for erecting transmission lines from the local plant to Vernon with a view of furnishing electricity for lamps and motors in that town.

TIPTON, IND.—The installation of three new boilers and other extensions to the municipal electric-light plant are under consideration. N. Hiatt is superintendent.

AUDUBON, IA.—The Creston Mutual El. Lt., Ht. & Pwr. Co., Creston, is contemplating extending its transmission lines to this place to supply electrical service.

BOONE, IA.—Preparations are being made for the extension of the transmission lines of the Boone El. Co. to the towns of Slater, Madrid, Woodward, Luther and Perry.

COON RAPIDS, IA.—At an election held recently the proposition to grant a 20-year electric-light franchise to Mr. Henry was carried. It is proposed to establish a 24-hour service. Orders have been placed for a second engine and generator.

DOWS, IA.—The Dows El. Lt. & Power Co. is contemplating the installation of an electric light and power plant to be operated by gas engines.

FONTANELLE, IA.—Plans are being considered for the installation of an electric-lighting system here.

FORT MADISON, IA.—The City Council has granted the Mississippi River Pwr. Co. a 25-year franchise to supply electricity in Fort Madison.

GARDEN GROVE, IA.—The Leon El. Co., Leon, is contemplating extending its transmission lines to Garden Grove.

GILMORE CITY, IA.—At an election to be held Sept. 5 the proposition to grant a franchise to supply electricity in Gilmore City will be submitted to a vote. Propositions have been submitted to the city for furnishing electrical service by the Fort Dodge Portland Cement Co., the Humboldt Dam Co. and the Fort Dodge Lt. & Pwr. Co.

MUSCATINE, IA.—The Davenport-Muscatine Interurban Ry. Co. has been granted a franchise to use the streets of the city.

NEVADA, IA.—Negotiations are under way between the Dow syndicate, of Cedar Rapids, and the officials of the Nevada El. Co. for the purchase of the Nevada electric plant. The Dow syndicate is also negotiating for other plants along the Northwestern and tributary lines.

NEW LONDON, IA.—At an election held recently the proposition to issue additional bonds for the municipal electric-light plant was carried.

NORTH LIBERTY, IA.—The Iowa City & Cedar Rapids Ry. & Lt. Co. has been granted a franchise in this city.

OGDEN, IA.—At a special election held recently the proposition to grant the Central Iowa Lt. & Pwr. Co. a franchise to supply electricity for lamps and motors here for a period of 10 years was carried. Energy will be delivered at the Ogden plant at 2 cents per kw-hr. and distributed over the municipal system. The company agrees to take over the machinery of the old plant, for which it will pay $3,600.

PETERSON, IA.—Steps have been taken to organize a company to install and operate an electric plant here. Work has commenced on the construction of mill and dam. The equipment will include two new water turbines, a new Corliss engine and high-pressure boiler and two electric generators. The company contemplates extending its transmission lines to Sutherland. The company will be capitalized at $50,000. D. McMillan, A. O. Anderson, E. L. Mantor, W. E. Landsbery and A. W. Jones, of Peterson, are interested.

ROLFE, IA.—The Northern Lt., Ht. & Pwr. Co., Humboldt, has been granted a franchise to supply electricity in Rolfe.

SLOAN, IA.—Preparations are being made by the Town Council for the installation of an electric-light plant, bids for which will soon be received.

STORM LAKE, IA.—The installation of an ornamental street-lighting system in Storm Lake is under consideration.

WHITING, IA.—Steps have been taken by local business men for the installation of an electric-light plant.

SALINA, KAN.—Extensive improvements are to be made to the plant of the Salina Lt., Pwr. & Gas Co., which will include the installation of a 750-kw generating unit, a new gas holder and extension of lines, etc. An addition will also be built to power house.

SUMMERFIELD, KAN.—The City Council has granted a 20-year franchise to Harry D. Hockman, Beattie, to install and operate an electric plant. Electricity for operating the system will be secured from Mr. Hockman's plant in Beattie, 14 miles distant.

HORSE CAVE, KY.—The proposition to appropriate $5,000 for the construction of an electric-light plant in Horse Cave will be submitted to the voters on Nov. 5. Cyrus Edwards is clerk.

MIDWAY, KY.—The Middle West Utilities Co., Chicago, Ill., is negotiating for the purchase of the municipal electric-light plant in Midway. If taken over by the company it is proposed to enlarge the plant.

LAFAYETTE, LA.—At an election to be held Sept. 16 the proposition to appropriate funds for rebuilding the electric-light and waterworks plant will be submitted to a vote. It is proposed to substitute internal-combustion engines for steam, build and equip a fire station and install an electric fire-alarm system. A. R. Traban is Mayor.

LAKE PROVIDENCE, LA.—The city is planning to install an additional engine and dynamo in the municipal electric-light plant.

JAY, MAINE.—It is reported that the International Paper Co. has awarded a contract to the H. P. Cummings Co., Ware, Mass., for the construction of a hydroelectric power plant here, to develop 3000 hp.

SACO, MAINE.—Options are being obtained in Poland, Mechanic Falls, Casco, Raymond, Windham and Gorham for the erection of a high-tension transmission line from Oxford County to Biddeford and Saco by the York Pwr. Co. Power for the system will be obtained from the plant of the Rumford Falls Pwr. Co., Rumford.

SOUTH BERWICK, MAINE.—The property of the Berwick & Salmon Falls El. Co. has been purchased by the Twin State Gas & El. Co., Dover, N. H.

ASHBURNHAM, MASS.—The citizens have voted to appropriate $2,500 for the erection of a three-phase transmission line to Naukeag Lake, together with necessary transformers.

CHICOPEE, MASS.—Mayor Rivers has vetoed the ordinance granting a franchise to the Amherst Pwr. Co. to supply electricity in Chicopee.

CLINTON, MASS.—The Metropolitan Water and Sewerage Board has awarded the contract for the erection of a transmission line from the Wachusett dam to the pumping station in Clinton to the Lt., Ht. & Pwr. Constr. Co. of the Massachusetts Ltg. Cos. Electricity generated at the dam will be used to operate the sewage pumps in Clinton.

HAVERHILL, MASS.—A complete rearrangement of the street-lighting system is contemplated by the Municipal Council, under the new contract, which includes the substitution of incandescent lamps for naphtha lamps used in the outlying districts. This will increase the number of incandescent lamps from 88 to 213. The installation of 64 magnetite ornamental arc lamps to replace the 14 arc lamps now in use in the business district is contemplated. It is also proposed to substitute incandescent or gas lamps for 75 arc lamps on streets shaded with trees, four of the new lamps to take the place of one arc lamp. The present contract expires in November.

MARBLEHEAD, MASS.—Plans are being considered for moving the municipal electric-light plant from its present location to Leggs Hill to be operated in connection with the water-works system.

NORFOLK, MASS.—Bids will be received by the trustees of the Foxborough and Norfolk State Hospitals, care of Kendall, Taylor & Co., architects, 93 Federal Street, Boston, Mass., until Sept. 4, for construction of administration building, superintendent's house and six cottages, power house with electrical equipment and laundry building for the Norfolk State Hospital, plans and specifications for which may be seen at the office of the architects.

ORLEANS, MASS.—Plans are being considered for the installation of a municipal electric-light plant and water-works system in Orleans.

DOWAGIAC, MICH.—The City Council has authorized W. E. Reynolds, superintendent of the municipal electric-light plant, to secure estimates on the installation of a generator to supply electricity for commercial lighting.

IRON RIVER, MICH.—The steam auxiliary power plant of the Peninsula Pwr. Co., Iron Mountain, located in Iron River, will be increased from 1000 hp to 2000 hp this fall. F. A. Joslin, Oshkosh, is vice-president of the company.

BELLE PLAINE, MINN.—A movement has been started by the Commercial Club for the installation of ornamental street lamps.

BRECKENRIDGE, MINN.—The City Council is contemplating improvements to the light and water plants.

CHISHOLM, MINN.—The court has authorized the receiver of the Range Pwr. Co. to make extensions to the plant to meet the demand for electrical service.

DULUTH, MINN.—A movement has been started by the West End Improvement Society for the installation of street lamps in the Seventh Ward.

KENYON, MINN.—The Consumers' Pwr. Co., Faribault, is considering the question of extending its service to Kenyon.

MINNEAPOLIS, MINN.—The Village Council of West Minneapolis has granted the Minneapolis General El. Co. a franchise to construct and operate an electric system there for a period of 25 years.

OLIVIA, MINN.—Bids will be received by the village of Olivia until Sept. 10 for furnishing and installing one 100-hp, 90-hp or 80-hp gas producer for either anthracite or bituminous coal or both, together with all auxiliary apparatus, etc., complete; one horizontal or vertical producer-gas engine of at least 80 hp, together with all appurtenances, complete; frame or brick extension to engine room. Plans and specifications on file in the office of the Oscar Claussen Engineering Co., National German-American Bank Building, St. Paul, Minn., and at the office of John Flaschenriem, village recorder, Olivia.

ST. PETER, MINN.—Plans are being considered for the installation of an ornamental lighting system on Minnesota Avenue.

WARREN, MINN.—The City Council contemplates making extensions to the municipal electric-light plant, to cost about $12,000.

WATERTOWN, MINN.—An electric franchise has been granted to the Central Minnesota Lt. & Pwr. Co. in Watertown.

BILOXI, MISS.—Steps have been taken toward the installation of a new street-lighting system for this city, the cost of which is estimated at about $48,000. It is proposed to discard the present arc lamps and use 50-cp or 60-cp tungsten lamps and to erect an ornamental lighting system in the business district.

BOONEVILLE, MISS.—The installation of an electric-light plant and water-works system is being promoted by the Business Men's League. Bids have been asked for. A. J. McIntyre is president.

JOPLIN, MO.—The Empire District El. Co. has submitted a proposition to the City Council offering to take over the municipal electric-light plant and to enter into a contract with the city for electricity to light the streets and all places now supplied by the city plant. The company offers to furnish magnetite arc lamps at $45 each per year and to install ornamental lamp standards, to cost $60 each. It has also made an offer to lease the municipal plant for $5,000 per year or to purchase it for $60,000. An offer was also submitted to furnish electricity to operate the plant.

MARYVILLE, MO.—The Maryville El. Lt. & Pwr. Co., recently organized by Richard Kuchs and others, is planning to build an electric light and power plant.

ST. LOUIS, MO.—The Union El. Lt. & Pwr. Co. has awarded a contract for 113 miles of electric cable to transmit the current from the transformer station of the Mississippi River Pwr. Distributing Co. at Page Boulevard and the city limits to the plant of the Union company at Ashley Street, at a cost of about $1,000,000. The General El. Co. and the Standard Underground Co. were awarded the larger part of the contract.

SHELDON, MO.—Plans are being considered for the installation of a municipal electric-light plant here.

BUTTE, MONT.—Plans have been prepared by the City Council for a new lighting system for the main streets of the city. The cost of installing the system is estimated at $37,175, and provision is made for 366 lamps.

DONIPHAN, NEB.—Plans are being considered for the installation of an electric-light plant and water-works system in Doniphan.

GERING, NEB.—The City Council has accepted the proposition of the Cross & Roberts El. Co., Scottsburg, to supply electricity for lighting this city.

KEARNEY, NEB.—The City Council has instructed the city clerk to notify the Kearney El. Lt. & Pwr. Co. to discontinue the street-lighting service. The clerk was also instructed to prepare an ordinance compelling the company to remove its poles and wires from the streets. The Council has also decided to call a special election to vote on the proposition to issue bonds for establishing a municipal electric-light plant. An injunction has been secured against the City Council preventing it from selling $40,000 in bonds which were authorized last February for the installation of a lighting system.

CHATHAM, N. J.—The Borough Council has passed an ordinance providing for extensions to the municipal electric-light plant and for a bond election for the purpose of voting on the proposition to issue $35,000 for proposed improvements. The Board of Water Commissioners has been authorized to advertise for bids for the following equipment: Additional generating unit and exciter, steam engine and electrically driven pump, one 75-kw, 2300-volt, three-phase generator, one 35-hp, 2300-volt, three-phase motor, two 150-hp B. & W. water-tube boilers, one 250-hp condenser, one radial brick chimney, switchboard, piping and changes in feeders.

JERSEY CITY, N. J.—Proposals will be received by the Board of Chosen Freeholders of the County of Hudson, Court House, Jersey City, until Sept. 5 for lighting by electricity the public and county roads. Specifications may be seen at the above office. Walter O'Mara is clerk.

PASSAIC, N. J.—Arrangements are being made by the Board of City Commissioners and the Shade Tree Commission for placing all overhead wires, both transmission and distributing lines, for traction and electric-lighting service in underground conduits.

PENNS GROVE, N. J.—Preparations are being made by the Penns Grove El. Lt., Ht. & Pwr. Co. for the construction of a power plant here to supply electricity in Penns Grove and surrounding towns.

CADYVILLE, N. Y.—The International Paper Co. is reported to have awarded a contract to the H. P. Cummings Constr. Co., Ware, Mass., for the construction of a dam 175 ft. long and 54 ft. high, in Cadyville.

CATSKILL, N. Y.—The Public Service Commission has authorized the Catskill Illg. & Pwr. Co., the Schoharie Lt. & Pwr. Co. and the Upper Hudson El. Lt. & R. R. Co. to consolidate under the name of the Upper Hudson El. Lt. & R. R. Co. The Schoharie Lt. & Pwr. Co. is authorized to purchase the property of the Cairo El. & Pwr. Co. before the merger is accomplished.

LE ROY, N. Y.—The Public Service Commission has authorized the Le Roy Hydraulic El. Gas Co. to execute a mortgage on its property to secure a bond issue to the amount of $100,000, and to issue at this time $65,000, to be sold at not less than 95, the proceeds to be used for the discharge of obligations amounting to $38,000 and for the installation of a turbine engine, condenser, water-purifying plant and boiler in its power plant.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Sept. 4 for installing electric equipment in the first portion of the new Normal College buildings, Thomas Hunter Hall, on Lexington Avenue, between Sixty-eighth and Sixty-ninth Streets. Blank forms, plans and specifications may be obtained at the office of the superintendent. Egerton L. Winthrop, Jr., is chairman board of trustees.

NEW YORK, N. Y.—Sealed proposals will be received by the State Hospital Commission, Capitol, Albany, until Sept. 9, for furnishing a compressor refrigerating plant at the Manhattan State Hospital, Ward's Island. Plans and specifications may be seen and blank forms of proposal obtained at the Manhattan State Hospital, Ward's Island, at the office of the State Hospital Commission, 1 Madison Avenue, New York, and at the office of Herman W. Hoefer, state architect, Capitol, Albany. Plans may be secured at the office of the state architect. T. E. McGarr is secretary of the commission.

NIAGARA FALLS, N. Y.—The Niagara Falls Business Men's Association has voted in favor of establishing a municipal electric-light plant.

PLATTSBURG, N. Y.—Plans are being considered by the Champlain Paper Co. and the Progressive Pulp & Paper Co. for the construction of a power plant on their property in Plattsburg.

PORTLAND, N. Y.—The Niagara & Erie Pwr. Co. has applied to the Public Service Commission for authority to issue $20,000 in capital stock and to issue $60,000 in bonds. Permission is asked to sell the bonds at $80, the proceeds to be used for the acquisition of right-of-way from West Portland and the erection of a high-tension transmission line southwesterly to the boundary line of the State of Pennsylvania, a distance of 17 miles, and for reimbursement of the treasury for the cost of extensions and improvements made since Feb. 1, 1911. The cost of the transmission line is estimated at $40,000.

TONAWANDA, N. Y.—Several of the companies operating lumber and woodworking plants in this section have asked the Tonawanda Pwr. Co. for estimates of the cost of equipping their plants for electrical operation. The Eastern Lumber Co. has discarded steam power entirely and is using electricity for motive power. F. M. Gordon is manager of the Tonawanda Pwr. Co.

UTICA, N. Y.—The Utica & Mohawk Valley R. R. Co. has applied to the Public Service Commission for approval of franchises granted by the town of German Flats and the villages of Ilion and Mohawk for extensions and improvements to its system in those places.

WADDINGTON, N. Y.—The New York & Ontario Pwr. Co. is planning to rebuild its power plant here, work on which will begin at once.

WEEDSPORT, N. Y.—Estimates have been submitted by the Rochester, Syracuse & Eastern R. R. Co. for the installation of an electric-lighting system in Weedsport. The cost of installing a street-lighting system is estimated at $10,246 and that of a commercial system at $3,800, making a total of $14,046. This covers the erection of a transmission line from Port Byron substation. The plans provide for the installation of 80 250-watt lamps for street lighting.

RANDELMAN, N. C.—Preparations are being made for the installation of a new electric-power plant for the Deep River Mills, to cost about $65,000. Orders have been placed for a 1000-hp cross-compound condensing engine for direct connection to a 600-kw generator. Contracts have also been awarded for boilers, pumps, condensers and generator.

LARIMORE, N. D.—The City Council is contemplating the installation of an ornamental street-lighting system in the business district.

ASHLAND, OHIO.—The installation of cluster lamps in the business district is under consideration.

CLEVELAND, OHIO.—The Cleveland Ry. Co. has applied to the Public Service Commission for permission to issue $3,015,000 in capital stock, of which the proceeds of $1,493,000 will be used toward paying for improvements as agreed upon between the company and the City Council, to cost $2,500,000, the remaining $1,522,000 to retire a similar amount of bonds. The proposed expenditure for improvements includes: Land for substations, $50,000; buildings, $20,000; equipment for substations, $500,000; track renewals, $700,000; track extensions, $250,000; cars, $450,000; automobiles, $10,000, and fire protection, $33,000. Electricity for operating substations will be secured from the Cleveland El. Illg. Co.

COLUMBUS, OHIO.—Sealed proposals will be received by S. A. Kinnear, director of public safety, Columbus, Ohio, until Sept. 10 for furnishing one 600-kva Taylor-connected and two 100-kva Scott-connected transformers, in accordance with specifications on file in the office of the director of public safety and office of the superintendent of the Department of Lighting, Dublin Avenue, from whom copies may be obtained.

DAYTON, OHIO.—The contract for lighting North Ludlow Street has been awarded to the Dayton Ltg. Co., at $55 per standard.

DAYTON, OHIO.—The Central Union Tel. Co. contemplates improvements to its local system involving an expenditure of about $31,000.

DAYTON, OHIO.—The capital stock of the Dayton & Troy El. Ry. Co. has been increased from $1,000,000 to $1,300,000. The proceeds will be used for improvements to the system.

WILMINGTON, OHIO.—Under terms of the contract recently awarded the Wilmington Wtr. & Lt. Co. for lighting the streets of the village for a period of 10 years, the company is to replace the present arc lamps with new arc lamps. The new contract goes into effect Feb. 1, 1913.

TULSA, OKLA.—The property of the Tulsa Corpn., which operates the electric plant in Tulsa, has been purchased by the Middle West Utilities Co. for about $1,000,000.

ENTERPRISE, ORE.—H. Hirschberg, it is reported, is interested in a project to build an electric-light and water plant.

EUGENE, ORE.—The Portland, Eugene & Eastern El. Ry. Co. has awarded the contract for construction of the Monroe-Eugene line, a distance of about 25 miles, to Flagg & Standifer.

LA GRANDE, ORE.—Plans are being considered by the City Council for the installation of a fire-alarm system here.

PORTLAND, ORE.—The City Council has passed the resolution granting the Northwestern El. Co. a franchise to operate in this city. Mortimer Fleishhacker, San Francisco, Cal., is interested in the company.

SUMPTER, ORE.—The electric plant of the Northwestern Lt. & Pwr. Co. was recently destroyed by fire, causing a loss of about $10,000. The plant will be rebuilt at once.

THE DALLES, ORE.—The Pacific Pwr. & Lt. Co. will soon begin work on the erection of a new transmission line between The Dalles and the power plant at White River. The new line will carry 66,000 volts. B. P. Bailey is local manager.

BELLEVUE, PA.—The merger of Ohio Valley El. Cos. of Avalon, Ben Avon, Bellevue and Emsworth under the name of the Ohio Valley El. Co. has been approved by Governor Tener. The new company is capitalized at $62,700 and the officers are: J. D. Callery, president; W. B. Carson, secretary, and C. J. Braun, Jr., treasurer.

CARROLL, PA.—Application will be made to Governor Tener by Samuel R. Smith, Martin E. Kraybill, C. J. Kraybill, John E. Kraybill and others for a charter for a corporation to be known as the Carroll Township El. Co. to supply electricity for lamps and motors in Carroll Township.

EPHRATA, PA.—The Borough Council has decided to purchase new equipment for the municipal electric-light plant, to cost about $10,000.

PERRYOPOLIS, PA.—The West Penn El. Co. has taken over the electric light and power business of the Washington Coal & Coke Co. in Perryopolis.

PITTSBURGH, PA.—Robert Daley, superintendent of the Bureau of Electricity, has recommended that an appropriation of $150,000 be given to the Department of Public Safety for the purpose of placing wires underground in Butler Street between Forty-third and Sixty-second Streets. Lateral conduits in which light, telegraph and telephone wires will be carrried are to be laid by the several companies, and it is proposed to place the police and telegraph wires owned by the city at the same time.

PITTSBURGH, PA.—The West Penn Rys. Co. has commenced work on the erection of its transmission lines from the Connellsville district to the property recently acquired by the Kuhn interests on the Cheat River. The new lines will be supplied for the present from the power plant at Connellsville, but eventually will form a part of the Cheat River power system. Transmission lines are being erected from Greensburg, Sewickley, Freeport, Butler, Kittanning and Saltsburg to the site of the dam at Cheat River.

SOUTH BETHLEHEM, PA.—The Bethlehem Steel Co. is planning to install a Girod electric furnace at its plant.

HEBRONVILLE, R. I.—The Attleboro Steam & El. Co., Attleboro, is planning to make changes in its present system here and to replace the arc lamps with incandescent lamps. Edgar Tregoning, Attleboro, is manager.

NEWPORT, R. I.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 21 for one 15-ton manually operated single-trolley traveling crane, 48 ft. 11½ in. span, for the central power plant at the United States torpedo station, Newport, R. I. The cost is estimated at $1,800. William M. Smith is acting chief of bureau.

ARLINGTON, S. D.—At an election held Aug. 17 the proposition to issue $10,000 in bonds for the installation of an electric-light plant was carried. An engineer has not yet been engaged.

FAIRVIEW, S. D.—The Sioux Valley Wtr. Pwr. Co. is seeking franchises to supply electricity in Inwood, Hudson, Fairview, Hull, Doon and other Iowa towns. The plant will be erected on the Big Sioux River between Sioux Falls and Sioux City. The contract for construction of dam and power plant has been awarded to L. O. Latimer, Eldora, Ia.

KIMBALL, S. D.—A company is being formed for the purpose of supplying electricity in Kimball.

EAST LAKE, TENN.—Steps have been taken by the residents of East Lake to secure the installation of an electric-lighting system here.

LENOIR CITY, TENN.—The City Council has awarded a contract to the Lenoir Lt. & Pwr. Co. for lighting the streets of the city for a period of ten years. The contract calls for five 100-watt tungsten lamps in the business district and 40-watt tungsten lamps in the residence section.

AUSTIN, TEX.—Bids are being asked by the Dieter & Wenzel Constr. Co., Joplin, Mo., for electrical work on the post office building in Austin.

AUSTIN, TEX.—The Austin El. Co. has begun work on construction of an extension of its street-railway system to the site of the dam that is being constructed across the Colorado River, 2 miles west of the city.

HILLSBORO, TEX.—The City Council has granted the Southern Trac. Co. a franchise to construct and operate an electric railway over certain streets in Hillsboro.

HOUSTON, TEX.—Among the improvements contemplated by the Southern Pacific Company at its terminals here is the erection of a large central electric power plant, which will provide electricity for operating the machinery in the shops, boiler works and transfer table.

PALESTINE, TEX.—Negotiations have been closed whereby the plant and holdings of the Palestine El. & Ice Co. have been purchased by the Texas Utilities Corpn., of Dallas. The new company, it is understood, will enlarge the plant and also has under consideration the construction of an electric railway between Dallas and Palestine.

SANDERSON, TEX.—Arrangements are being made by E. McGinley for the installation of an electric-light plant here.

STEPHENVILLE, TEX.—The plant of the Stephenville Lt. & Wtr. Co. was damaged by fire recently, causing a loss of about $2,500.

ALDERTON, WASH.—The installation of an electric-light system in Alderton is under consideration.

BREMERTON, WASH.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 21 for electric wiring and fixtures in new general foundry building at the navy yard, Puget Sound, Wash., plans and specifications for which may be obtained on application to the bureau or the commandant of the navy yard named. William M. Smith is acting chief of bureau.

CENTRALIA, WASH.—Plans are being considered for the construction of a large power plant on Packwood Lake, near Centralia.

CLE ELUM, WASH.—Preparations are being made by the Kittitas Ry. & Pwr. Co. for the construction of an electric railway to Salmon la Sac, a distance of 31 miles. It proposed to erect a power station and dam at Salmon la Sac, with dams at Waptus and Cooper Lakes, costing $100,000 each. Guy C. Williams, engineer, Williamsburg, will have charge of the construction work.

NAPAVINE, WASH.—The Independent El. Co., a subsidiary of the Washington-Oregon Corpn., has applied to the commissioners of Lewis County for franchises to erect and operate a transmission line through Napavine to supply electricity here, and for a change of route from the old military road in southern Lewis County to the C. E. Leonard Road. The latter line will supply electricity in Winlock, Little Falls and Castle Rock.

SEATTLE, WASH.—William D. Hall, vice-president of the Grote-Rankin Co.; J. S. Wheeler, of Wheeler & Heath, and S. L. Cravens, president and manager of the Pacific Lumber & Timber Co., it is reported, are contemplating the construction of an interurban railway from Seattle to Olympia, via Tacoma. The company will be known as the Seattle-Tacoma-Olympia Ry. Co. and is capitalized at $1,500,000.

FAIRMONT, W. VA.—The Monongahela Valley Trac. Co. will soon award contracts for the construction of two new substations on its Weston extension, each to be equipped with one 300-kw rotary converter and other equipment.

MILWAUKEE, WIS.—The Badger Ry. & Lt. Co. contemplates extending its system from Whitewater to Jefferson.

PRESCOTT, WIS.—The Wisconsin Railroad Commission has ordered the Clifton Lt. & Pwr. Co., Prescott, to make improvements and extensions to its plant to enable it to meet the demands for electrical service.

WEST SALEM, WIS.—The State Railroad Commission has issued an order authorizing improvements to be made to the local electric-light plant within the next six months, or the commission may grant a certificate of public convenience and necessity for the erection of a new plant.

CHELSEA GREEN, ONT., CAN.—Petitions are being circulated by the residents of Chelsea Green asking the city of London to furnish Chelsea Green with electricity from its hydroelectric system.

HARRISTON, ONT., CAN.—The Town Council has decided to submit to the ratepayers in the near future a by-law providing for an appropriation of $12,000 for the installation of an electric-light system in Harriston.

PORT DALHOUSIE, ONT., CAN.—At an election held Aug. 19 the ratepayers voted in favor of the by-law to enter into a contract with the Hydro-Electric Power Commission to furnish electricity to this village.

## New Industrial Companies

THE AUTO GAS & ELECTRIC LIGHTING COMPANY, of Hilbert, Wis., has been incorporated with a capital stock of $10,000 by W. E. Bishop, J. W. Grupe, H. Grupe and C. Bishop.

THE CHASTTEEN SIGNAL SYSTEM COMPANY, of Chattanooga, Tenn., has been incorporated with a capital stock of $200,000 for the purpose of manufacturing a railway signaling device. W. J. Chastteen, of East Chattanooga, is president.

THE J. DUNCAN COMPANY, of Boston, Mass., has been incorporated with a capital stock of $50,000 by F. F. Judd, Winthrop; J. Duncan, Somerville, and C. T. Judd, Everett. The company proposes to manufacture trolley carriers, switches, etc. F. F. Judd is president.

THE ELECTRIC SPARK APPLIANCE COMPANY, of New York, N. Y., has been incorporated by Michael M. Lint, Peter Ross and Alexander Miller, of New York. The company is capitalized at $5,000, and proposes to manufacture electrical devices for automobiles.

THE GENERAL ENGINEERING & MANUFACTURING COMPANY, of Lynn, Mass., has been granted a charter with a capital stock of $30,000 for the purpose of doing general contracting work. The incorporators are: J. Coates, Coatesville, Pa.; M. M. Merritt, Middletown, and W. W. DeWolfe, Boston.

THE SUBMARINE WIRELESS COMPANY, of New York, N. Y., has been incorporated by Count Laszlo Széchényi, of Budapest, Hungary; E. N. Robinson, J. M. Russell and D. C. Watts, all of New York. The company is capitalized at $200,000 and purposes to build and operate systems for submarine telegraphy and signaling and transmission of messages under or through water by means of sound waves, vibrations or other devices.

THE UNION CAR & EQUIPMENT COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $250,000 to deal in railway equipment. The incorporators are: W. G. Davis, A. L. Jacobs and R. M. Davis.

THE UNIVERSAL VACUUM CLEANER MAINTENANCE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture vacuum cleaners, etc. The incorporators are: J. L. Lund, R. E. Lund, Brooklyn; N. P. Lund, Erie, Pa., and T. A. Berry, New York.

## New Incorporations

NORDHOFF, CAL.—The Ojai Pwr. Co. has been formed by J. J. Burke and E. L. Weist for the purpose of building an electric-light plant at Nordhoff.

ANGOLA, IND.—The Angola-Waterloo Utilities Co. has been granted a charter with a capital stock of $65,000 for the purpose of operating electric and water systems in Angola and also to operate in Steuben and DeKalb Counties. The directors are: J. W. Durfee, T. S. McGrath and James J. Elliott, of Chicago, Ill.

ANGOLA, IND.—The Indiana Utilities Co. has been incorporated with a capital stock of $200,000 for the purpose of acquiring and operating an electric railway between Angola and James Lake, and to acquire the electric-light plant in Angola and to erect and operate transmission lines, to supply electricity in Angola and other towns and cities in Steuben and DeKalb Counties. The directors are: John E. Van Meter, H. L. Hanley and A. M. Steelhamer, of Chicago, Ill.

WINCHESTER, IND.—The Citizens' Ht., Lt. & Pwr. Co. has been incorporated with a capital stock of $400,000 by J. T. Moorman, E. F. Kitselman, E. S. Goodrich, George E. Leggett, W. E. Miller and C. W. Moore. The company proposes to supply light, heat and power to towns and cities in the vicinity of Winchester.

MONMOUTH, IA.—The Monmouth Pwr. & Lt. Co. has been incorporated to operate a heat, light and power plant at Monmouth. It has an authorized capital stock of $10,000, and the incorporators are J. S. Walsh, John J. Ryan and P. Wagner, all of Davenport.

LOUISVILLE, KY.—The Kentucky Utilities Co. has been incorporated with a capital stock of $2,000,000 by William R. Watson, Charles J. Ruebling and L. Earle Powell, of Chicago. The company proposes to operate hydroelectric plants and distribute electricity for lamps, heat and motors; also to operate artificial gas plants, street and interurban railways, ice factories, etc.

FRANKFORT, MICH.—The Benzie Pwr. Co. has been organized by Col. Eugene Zimmerman, Cincinnati, Ohio, with a capital stock of $75,000. The company has secured water-power rights of the Betsey River and will begin work at once on the construction of a dam which will develop about 600 hp. Two other dams will be erected later.

LITTLE FALLS, MINN.—The Pike Rapids Hydro-Electric Co. has been incorporated to construct a power dam at Pike Rapids, near Little Falls. The proposed plant will supply electricity in this city. John L. McCauge, Omaha, Neb., is interested.

PRESTON, MINN.—The Root River Pwr. & Lt. Co. has been incorporated for the purpose of developing the water-power of Root River to generate electricity for use in Preston. The company is capitalized at $100,000 and the incorporators are: W. H. Williams, S. A. Langum, Ole T. Brokken, H. Somer, Jr., A. H. Hanning, Carl Hanning, A. G. Olson and others, all of Preston.

KANSAS CITY, MO.—Articles of incorporation have been filed by the Commerce Pwr. Co., its purpose being to generate and distribute steam, electricity and gas. The capital stock is given at $75,000, and among those interested are W. T. Kemper, J. Z. Miller, Jr., H. C. Schwitzgebel, R. C. Menefee and J. D. Rising.

FULTON, N. Y.—The Battle Island Pwr. Co. has been incorporated with a capital stock of $12,000 by Thomas Hunter, James C. Hunter and Robert B. Hunter, all of Fulton. The company proposes to develop water power.

HEBRON, N. D.—Articles of incorporation have been filed by the Hebron El. Lt. & Pwr. Co. It has a capital stock of $10,000, and the incorporators are T. Bolke and E. H. Mann, of Hebron, and A. Hannes, Pelican Rapids, Minn.

FREMONT, OHIO.—The Sandusky River Pwr. Co., with a capital stock of $9,000,000, has been organized with F. R. McMullin, of Chicago, as president, and several Fremont capitalists on the board of directors.

ARDMORE, OKLA.—The Ardmore Western Interurban Ry. Co. has been organized to construct an interurban electric belt railway covering a radius of 100 miles, making Ardmore the terminal point. A branch line will be built from Springer into Murray County. The company is capitalized at $250,000. J. S. Owen, D. E. Allen, T. C. Bridgeman, W. R. Burnitt, C. B. Kendrick and R. A. White, all of Ardmore, and Jesse L. Jordan, of Mariette, are interested in the project.

HARRISBURG, PA.—Charters have been granted by the State Department to the following companies: Hampton Lt. Co., to operate in Hampton Township; Valencia Lt. Co., Valencia Borough; Richland Lt. Co., Richland Township; Shaler Lt. Co., Shaler Township; Penn Lt. Co., Penn Township. Each company is capitalized at $5,000 and the incorporators are: C. R. Bartler, Butler; George Heard and C. H. Hays, Pittsburgh. The offices of the company are located in Pittsburgh.

CEDAR FALLS, S. C.—The Cedar Falls Lt. & Pwr. Co. has been incorporated by J. M. Geer, Greenville, and R. E. Davenport, Greer. The company proposes to construct a concrete dam to replace the wooden dam, and to install an electric plant to supply electricity for the cotton mills of the Katrine Mfg. Co., Fork Shoals.

FAIRFAX, S. C.—A charter has been issued to the Oil Mill Mfg. Co., of Fairfax, to operate an electric-light plant. The company is capitalized at $20,000, and the following officers have been elected: J. F. Lightsey, president; F. M. Young, vice-president; E. L. Young, secretary and treasurer.

DALLAS, TEX.—The Texas Utilities Corpn. has been incorporated with a capital stock of $240,000 by J. D. Oliger, Charles E. Hubbell and George H. White. The company will supply gas and electricity in 20 counties.

EL PASO, TEX.—The Rio Grande Valley Trac. Co. has been incorporated with a capital stock of $300,000 by Marshall M. P. Hinney, Theodore T. Whitney, of Boston, Mass.; Edwin B. Parker, C. R Wharton, J. H. Tallichet, Raymond Neilson and David Daly, of Houston.

MENARD, TEX.—The Menard Public Service Co. has been incorporated with a capital stock of $75,000, by J. L. Clark, J. L. Clark, Jr., and S. C. Rowe.

BEAVER CITY, UTAH.—The Beaver Milling & Pwr. Co. has been incorporated with a capital stock of $8,000. The officers are: Wilford Robinson, president; John M. Murdock, treasurer, and O. A. Murdock, secretary.

GREEN RIVER, UTAH.—The Green River Lt., Pwr. & Utility Co. has been incorporated with a capital stock of $300,000 to supply electricity to the town of Green River. The officers are: D. W. Parker, president; George Day, vice-president; S. J. Neer, secretary, and F. A. Sparks, treasurer.

MINERSVILLE, UTAH.—Articles of incorporation have been filed by the Minersville Milling & Pwr. Co. It is capitalized at $35,000, and the officers are: Frank Clayton, president; George Marshall, vice-president; A. L. Dotson, secretary and treasurer.

RUTLAND, VT.—The Western Vermont Lt. & Pwr. Co. has been incorporated with a capital stock of $2,300,000 by A. Livingston Norman, of New York, N. Y.; Thomas W. Moloney, W. H. Lawson, Myrick L. Arthur, Albert S. Reed and Charles H. West, of Rutland. The company will be an auxiliary to the Rutland Ry. & Lt. Co. and will purchase, operate electric and steam plants, electric railways. It is understood that the company will take over the Carvers Falls plant, which is now operated by lease with the option of purchase by the Rutland Ry. & Lt. Co.

FRANKLIN, VA.—The Chowan Wtr. & Pwr. Corp. has been granted a charter with a capital stock of $50,000. The officers are: C. W. Gary, president; W. O. Bristow, vice-president, and G. T. Stephenson, secretary and treasurer.

ROSSLYN, VA.—The Virginia Terminal Co. has been chartered for the purpose of building a street railway from Rosslyn, Va., to Washington, D. C. Work will begin on the railway as soon as authority is received from Congress. Harry Wardman and E. F. Crawford are interested.

POTLACH, WASH.—The Mason County Pwr. Co. has been incorporated with a capital stock of $2,000,000 to build a power plant in Potlach to supply electricity in various parts of Mason County. Frank McKean and others are incorporators.

SEATTLE, WASH.—The Western Pwr. Co. has been incorporated with a capital stock of $1,000,000. A. W. Wing and H. A. Wilson are among the directors.

WAYNE, W. VA.—The Wayne Lt., Ht. & Wtr. Co. has been granted a charter with a capital stock of $30,000 to operate water-works, heat and light plants, drill for oil and gas and market same. The incorporators are: B. J. Prichard, E. R. Prichard, Wayne; J. R. Miller, Eustis, Fla.; H. H. Jones and I. B. Reed, Crafton, Pa.

CAMBRIDGE, WIS.—The Cambridge Lt. & Pwr. Co. has been incorporated with a capital stock of $7,000 by A. C. Amundson, H. C. Stair and J. W. Porter.

MILWAUKEE, WIS.—The Northern El. Co. has been granted a charter with a capital stock of $5,000. The incorporators are: William G. Schenk, Thomas G. Perry and August E. Mauthey.

# Trade Publications

WIRE.—A folder just distributed by the Duplex Metals Company, Chester, Pa., presents a popular talk on its copper-clad steel wire, in which the statement is made that 50,000,000 lb. of this wire is now in use.

VALVES.—The Nelson blow-off valve is the subject of a twelve-page pamphlet issued by the Nelson Valve Company, Philadelphia, Pa. It is stated that this valve has no seats, no disks and no taper joints to get out of order.

DIE SETS.—The J. M. Carpenter Tap & Die Company, Pawtucket, R. I., in a small four-page folder, gives a table containing set numbers, cutting sizes, length of stock and prices of its machinists' and blacksmiths' screw plate sets.

ELECTRICAL APPARATUS IN AGRICULTURE.—The Allgemeine Elektricitäts Gesellschaft, Berlin, Germany, in its Bulletins Nos. 4 and 9, which have recently been received, illustrates and describes its portable electric motors for various uses on the farm.

LUBRICATION.—Book No. 117 of the Chicago Pneumatic Tool Company, Chicago, Ill., sets forth the importance of proper lubrication for machinery in general and for the Rockford railway motor cars in particular. It emphasizes the vital necessity of proper lubrication and gives the reasons therefor.

OIL DETECTOR.—A leaflet on the Rollins oil detector for attaching to oil separators bears the imprint of the Rollins Steam Specialty & Valve Company, 17 West Kinzie Street, Chicago, Ill. This detector was designed for testing and checking the efficiency of oil separators and open feed-water heaters.

ELECTRICAL SPECIALTIES.—Knapp Electric & Novelty Company, 511 West Fifty-first Street, New York, in Catalog No. 22 illustrates and describes its various miniature motors, dynamo-motors and miniature railways and other specialties. It contains also a four-page supplement on Knapp electric fans.

ELECTRICAL SUPPLIES.—Additional sheets for the catalog and data book of the Acme Electric Company, Knoxville, Tenn., have been received. Among other things they contain various kinds of useful information, such as how to remember the wire table, equivalents of electrical units and other matter of value.

CABLE CLIPS, GUY ANCHORS, ETC.—Leaflets on the Matthews cable clips, cable rollers, cable-splicing joints and guy anchors are being sent out by W. N. Matthews & Brother, 3722 Forest Park Boulevard, St. Louis, Mo., accompanied by a circular letter, in which a free sample cable clip is offered to anyone interested.

HYDROELECTRIC DEVELOPMENT.—The General Electric Company has just issued Bulletin No. 4966, devoted to hydroelectric power developments. Various important developments of this nature are described—some of them in considerable detail—and numerous illustrations of both station and line construction are shown.

COPPER-CLAD STEEL.—The Duplex Metals Company, of Chester, Pa., has just published a new illustrated catalog entitled "Copper-Clad Steel for Telephone Service." This forty-five-page booklet describes the process of manufacture and presents in detail the properties of the product. It will interest all telephone, telegraph and signal men.

MOTORS.—Bulletin No. 491 is the successor to Bulletin No. 391, issued by the Triumph Electric Company, Cincinnati, Ohio, devoted to its direct-current steel-frame motors. A full description of the constructive features of these motors is followed by illustrations which indicate the variety of applications in many different industries in which the Triumph motors are used.

STEAM TRAPS.—Catalog No. 326 of the American Blower Company, Detroit, Mich., is devoted to the Detroit steam traps. These are applicable anywhere that steam heat is used and can be used for draining any system on which a pot, float or bucket trap is now or could be used. The catalog contains illustrations and descriptions of the trap system and shows typical applications.

LIGHTNING ARRESTERS.—The General Electric Company has recently issued Bulletin No. 4960, which illustrates and describes direct-current lightning arresters for use in connection with electric railways. Two types are described, the magnetic-blowout arrester and the aluminum arrester. The type to be used depends upon the conditions to be met, and this point is discussed in the bulletin.

SWITCHBOARDS.—Crane switchboards, manufactured by the Electric Controller & Manufacturing Company, Cleveland, Ohio, form the subject of an eight-page insert in *Common Sense*, a magazine issued by the same company and edited by Mr. David Gibson. The switchboard is said to embody certain new points of design which seemed desirable from consideration of convenience of operation and safety to the workmen.

SWITCHES.—The K-P-F Electric Company, 37 Stevenson Street, San Francisco, Cal., is distributing Bulletin No. 101, devoted to its 22,000-volt, 150-amp pole-top switch. Great simplicity is claimed for this apparatus, and its installation is said to require less labor and material than other switches designed for similar service. The leaflet explains the operation of the switch and gives details of construction and two illustrations.

ELECTRIC POWER IN THE LUMBER INDUSTRY.—Bulletin 4962, recently issued by the General Electric Company, is devoted to the use of electric power in lumber and woodworking industries. The bulletin contains illustrations of installations of motors used in connection with various branches of the industry, discusses alternating current versus direct current for such service and contains descriptions of several important installations.

HOUSEHOLD APPLIANCES.—"Cook with Electricity" is the title of a thirty-two-page pamphlet which is being distributed by the Hughes Electric Heating Company, 226 West Superior Street, Chicago, Ill., and is of interest alike to the central-station man and the housewife. The advantages of the electric range and other heating devices, the expense of operation, the form of construction, dimensions and prices, are all set forth in a convincing manner. The booklet is fully illustrated.

AUTOMATIC STOKERS.—Bulletin B-1 on the Class "E" stoker made by the American Stoker Company, 11 Broadway, New York, has just been published. This type is said to embody a distinct advance in design, and a claim is made by the manufacturers that it is more efficient than any stoker heretofore produced. The illustrations and descriptive matter, together with some useful data relating to steam calculations, combine to make a bulletin of interest to all present and prospective users of this type of apparatus.

INDUSTRIAL RAILWAYS.—The C. W. Hunt Company, West New Brighton, New York, has just published Catalog No. 12-1, describing its industrial narrow-gage railways. These railways first appeared thirty years ago and are now being operated in large numbers all over the world. The catalog illustrates and describes in detail the constructive features of this railway system, and throughout its pages appear illustrations showing installations in many parts of the country, handling a wide variety of material. Some useful engineering data are also included.

STREET LIGHTING.—The Macbeth-Evans Glass Company, Pittsburgh, Pa., in its illustrated Booklet No. 53, presents information of interest on the lighting of the Atlantic City Boardwalk. This famous pier has had much added to its attractiveness, by day as well as by night, since the installation of the new ornamental lighting system which called for the use of tungsten lamps in Alba diffusing globes made by this company. The posts are 60 ft. apart, on both sides of the promenade, and the entire installation presents a very handsome appearance.

LAUNDRY MACHINERY.—The current interest of the householder, as well as of the central-station man, in domestic appliances which may be used with electric drive makes the appearance of Catalog A of the Hurley Machine Company, Clinton and Monroe Streets, Chicago, Ill., rather timely. Typical laundry-room plans, two for high-class homes and one for medium-sized homes and apartment buildings, are illustrated. Specifications and excellent pictures of each style of machine for washing, wringing, drying and ironing are also given, with prices and other general information on the Thor apparatus.

FUEL ECONOMIZERS.—A comprehensive and fully illustrated catalog—No. 142—has been issued by the Green Fuel Economizer Company, Matteawan, N. Y., on the subject of its economizers, white-heat air heaters and mechanical-draft outfits. Beginning with a chapter on the reason for the economizer and following with others of a very practical nature dealing with all phases of the improvement of steam-plant economy via the fuel economizer, this publication will be found interesting and useful. Details of design and photographs of actual installations lend additional interest as showing recent developments in steam practice. A table showing the properties of saturated steam forms the closing matter.

INDIRECT LIGHTING.—A specimen of the fine art of catalog making is found in the unique and distinctive addition to the "bulletins" recently distributed by the National X-Ray Reflector Company, Chicago. It consists of sixty photogravures, 6 in. by 9 in., showing prominent installations of the company's "Eye Comfort" system in various types of interiors. On the back of each of these fine illustrations are given engineering data and a brief description of the applicability of the "Eye Comfort" system to that particular type of interior. Several new fixture designs are also illustrated. An article on "Indirect Illumination" and some comparative cost data add practical value to this rather distinctive form of publicity. The subject of illumination is receiving such wide attention at the present time that these new publications of the National X-Ray Reflector Company cannot fail to appeal alike to the dealer and contractor and the prospective user.

# Business Notes

BRYAN-MARSH KANSAS CITY OFFICE.—The Bryan-Marsh Electric Works of the General Electric Company, Chicago, have opened a branch office at 908 Broadway, Kansas City. The new office is known as the Southwestern sales office of the Bryan-Marsh Electric Works. Its manager is Mr. Sam Furst, who has been connected with the company for a number of years.

RECENT INSTALLATIONS OF LANG-McWILLIAMS METER PANELS.—Among recent office buildings to install the Lang-McWilliams "Simplicity" metering panels, by means of which the circuits of any room or rooms can be grouped under a desired meter by a simple plug adjustment, are the following: Rand McNally Building, Kaestner Build-

ing, Harris Trust and Savings Bank Building, Webster Building, Goddard Building, City Hall Square, Mallers Building, Lytton Building, Otis Building and Great Lakes Building, all of Chicago; Citizens' Bank Building, Tampa, Fla.; Merchants' Trust Bank Building, Indianapolis, Ind.; Detroit Free Press Building, Detroit, Mich.; First National Bank Building, Waterloo, Ia., and Jefferson Building, Peoria, Ill. These panels make possible permanent construction in the circuit lay-out of the building, all changes of tenants' circuits made necessary by changes in number of rooms to be connected under a given meter being accomplished by movable contacts between two transverse sets of busbars on the panelboard. The panels are manufactured by the J. Lang Electric Company, 421-429 North Lincoln Street, Chicago.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 20, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,035,873. PROCESS OF PRODUCING ENDOTHERMIC GAS REACTIONS AND APPARATUS THEREFOR; H. Grohmann, Cologne, Germany. App. filed Aug. 19, 1911. Annular air and gas nozzles concentric with an electrode; for forming nitrogen oxide, etc.

1,035,883. MANUFACTURE OF EXCEEDINGLY THIN METALLIC GLOWING FILAMENTS FOR ELECTRIC INCANDESCENT LAMPS; A. Lederer, Atzgerdorf, Austria-Hungary. App. filed April 3, 1906. A filament of paste is reduced by sintering.

1,035,894. GAS-FEED VALVE FOR VACUUM TUBES; D. McF. Moore, Newark, N. J. App. filed Dec. 31, 1910. Automatic valve intended to prevent loss in shipment.

1,035,919. REDUCTION OF BORON COMPOUNDS; F. T. Tone, Niagara Falls, N. Y. App. filed Jan. 18, 1909. A bath of boron compound, fluxing-material, reducing-agent, metalliferous material is fused in an electric circuit.

1,035,931. BENDABLE INCLOSING CASING; A. E. Woodhouse, Kingsway, London, England. App. filed March 7, 1910. A trough and its cover are indented along the edges and sides.

1,035,958. PROTECTIVE APPARATUS FOR RADIOTELEGRAPHIC STATIONS; E. Girardeau, Paris, France. App. filed May 26, 1911. Ultra-violet rays are generated near the spark-gap.

1,035,964. MACHINE FOR AND METHOD OF ELECTRIC WELDING; E. I. Heinsohn and W. R. Edwards, Cleveland, Ohio. App. filed Dec. 4, 1911. Rotating electrodes for lap-welding tubes, etc.

1,035,971. SELECTIVE SIGNALING APPARATUS; D. W. Kneisly, Dayton, Ohio. App. filed May 3, 1909. Party-line telephone lock-out.

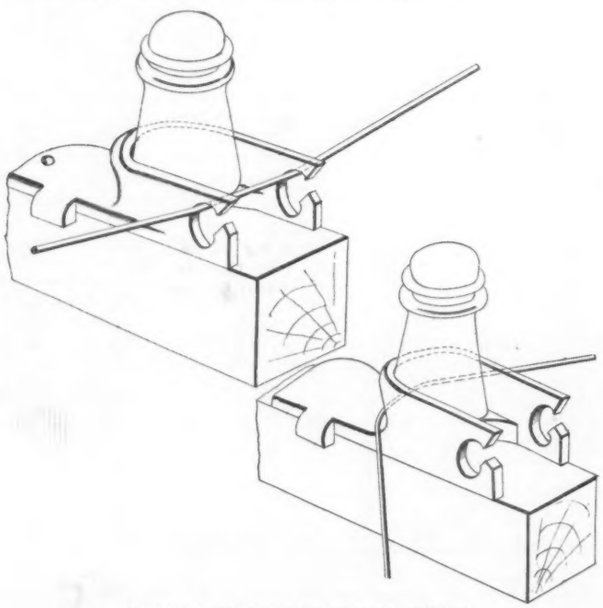
1,035,986. TROLLEY-POLE CONSTRUCTION; A. K. McQuade, Pittsburgh, Pa. App. filed June 4, 1910. The pole is operated from the interior of the car.

1,035,994 DEVICE FOR PASSING CABLES THROUGH PIPE LINES; O. B. Mueller, New Rochelle, N. Y. App. filed Nov. 11, 1909. An expansible cup piston is provided with a pulling cable and a contracting cable.

1,036,010. WEATHERPROOF ELECTRICAL RECEPTACLES; F. J. Russell, New York, N. Y. App. filed Jan. 25, 1908. Plug and lamp socket with a helical wire holder.

1,036,019. ELECTRIC SNAP SWITCH; T. M. Smith, New York, N. Y. App. filed March 17, 1909. Terminal molding switch.

1,036,056. IMPULSE TRANSMITTER; C. R. Austin, Los Angeles, Cal. App. filed Feb. 15, 1911. Dial type for telephones.



1,036,136.—Tool for Stringing Line Wires.

1,036,063. VENTILATING AND COOLING SYSTEM FOR BATTERIES; C. H. Bedell and G. E. Edgar, New London, Conn. App. filed Aug. 7, 1911. For submarine boats, etc.

1,036,077. SWITCHBOARD AND RHEOSTAT; E. M. Crane, Detroit, Mich. App. filed March 22, 1909. For dental laboratory motors, lamps, driers, furnaces, etc.

1,036,112. TROLLEY SPLICE; E. Heydon, Indianapolis, Ind. App. filed April 20, 1912. Clamp for holding the ends of wire in alignment.

1,036,114. DEVICE FOR PASSING CABLES THROUGH PIPE LINES; B. B. Hodgman, East Orange, N. J. App. filed April 15, 1910. The carrier cup has a plurality of compartments.

1,036,115. SWITCH LOCK FOR IGNITION CIRCUITS; P. Hoffmann and T. H. Hupfer, St. Louis, Mo. App. filed Feb. 23, 1912. Pin-tumbler lock and multiple switch.

1,036,116. AUTOMATIC TEMPERATURE REGULATOR; H. Hohlmann, Jr., Essen-on-the-Ruhr, Germany. App. filed Feb. 6, 1911. For cooking receptacles, etc.

1,036,126. ELECTRIC SWITCH; F. Kuhn and F. E. Shailor, Detroit, Mich. App. filed June 27, 1910. Rotatable cylinder for electrically heated warming pads, etc.

1,036,136. TOOL FOR STRINGING LINE WIRES; H. A. Menager, Gallipolis, Ohio. App. filed Jan. 7, 1911. For holding the wire on the cross-arm before tying.

1,036,143. TERMINAL FOR IGNITERS; R. M. G. Phillips, Minneapolis, Minn. App. filed Feb. 21, 1911. A slip joint between the conductor and the binding post.

1,036,177. ELECTRICAL DISTRIBUTING CABINET; A. E. Blackman, Mount Vernon, N. Y. App. filed June 15, 1910. Junction device for sectional boxes having hinged covers.

1,036,286. TROLLEY; G. E. Lynch, Chelsea, Mass. App. filed June 21, 1907. A torsion spring for a pivoted trolley arm.

1,036,293. SWITCH AND CUT-OUT DEVICE; A. V. A. McHarg, New York, N. Y. App. filed March 28, 1912. Multiple manually operated switch lever and removable fuses.

1,036,294. SWITCH; A. V. A. McHarg, New York, N. Y. App. filed April 8, 1912. Push-button socket switch.

1,036,296. CONNECTOR FOR ELECTRICAL CONDUITS; A. McMurtrie, New York, N. Y. App. filed Sept. 17, 1907. Box connector for flexible metallic conduit, etc.

1,036,304. ELECTRICAL RESISTANCE; J. A. Misland, Bayonne, N. J. App. filed May 23, 1910. A coil is gradually short-circuited by compressing it on a conducting support.

1,036,317. CASING; G. E. Palmer, Winchester, Mass. App. filed June 6, 1910. For meters and cut-outs.

1,036,326. ELECTRIC PULL-SOCKET SWITCH; W. Pfeifer, Jr., Jersey City, N. J. App. filed Jan. 22, 1912. Making and breaking contact details.

1,036,344. PRIMARY BATTERY; A. L. Saltzman, East Orange, N. J. App. filed Feb. 28, 1911. Copper oxide and zinc type. (Improvement on Dodge patent, No. 894,487.)

1,036,372. ELECTRIC SIGNALING SYSTEM; J. D. Taylor, Edgewood Park, Pa. App. filed Jan. 11, 1910. Railway block system with continuous rails.

1,036,373. RAILWAY SIGNALING MECHANISM; J. D. Taylor, Edgewood Park, Pa. App. filed May 26, 1910. The signal-actuating motor holds the signal in its clear position.

1,036,402. TROLLEY POLE; W. L. Wright, Philadelphia, Pa. App. filed Jan. 19, 1909. Tapered tubular sheet-metal pole.

1,036,411. ELECTRICAL ADVERTISING DEVICE; N. O. Anderson and F. O. Hutchings, San Francisco, Cal. App. filed Dec. 7, 1911. Rotatable sign with colored lights.

1,036,417. DISTANT-CONTROL ELECTRIC SWITCH; C. C. Badeau, Winthrop, Mass. App. filed Feb. 17, 1911. Iron-clad magnet and mechanical details.

1,036,418. COMBINED SOCKET AND SWITCH FOR ELECTRIC LIGHTS; D. A. Bailey, Fort Worth, Tex. App. filed Feb. 24, 1912. A number of lamps can be controlled from a single socket.

1,036,423. PROTECTING DEVICE FOR METER CONNECTIONS; P. H. Bartlett, Philadelphia, Pa. App. filed March 19, 1912. A metal box with a hinged door and a metal adapter box.

1,036,437. IRON ARM AND KNOB; F. Browalski, Worden, Ill. App. filed March 30, 1912. Pole-insulator construction.

1,036,443. TELEGRAPH KEY; G. V. Buqoui, St. James, La. App. filed Oct. 30, 1911. The key is operated by a horizontal rolling motion of the hand.

1,036,445. SERIES TRANSFORMER; G. A. Burnham, Cliftondale, Mass. App. filed March 31, 1911. The ratio may be changed for accommodating different loads.

1,036,457. TROLLEY; N. B. Coon, North Braddock, Pa. App. filed Jan. 4, 1912. Has yielding gripping members.

1,036,471. STORAGE BATTERY; T. A. Edison, Llewellyn Park, West Orange, N. J. App. filed June 6, 1910. Powdered nickel hydroxide and bismuth are compressed into a perforated pocket.

1,036,477. TROLLEY-SUPPORTING MECHANISM; D. T. Fisher, Columbus, Ohio. App. filed Feb. 10, 1909. Spring device for mine locomotives, etc.

1,036,498. PROCESS OF MAKING STEEL; F. B. Lamb, Bettendorf, Ia. App. filed Jan. 3, 1911. The charge is liquefied, bessemerized and electrically refined in a single vessel.

1,036,499. METALLURGICAL FURNACE; F. B. Lamb, Bettendorf, Ia. App. filed Feb. 28, 1911. Tilting open-hearth regenerative furnace with a converting chamber.

1,036,507. METER-TESTING CONNECTION BLOCK; T. E. Murray, New York, N. Y. App. filed Sept. 1, 1911. Spring bridge for a gang plug.

1,036,508. CONNECTION DEVICE FOR CIRCUIT CONDUCTORS; T. E. Murray, New York, N. Y. App. filed March 9, 1912. Plurality of interchangeable insulating blocks.

1,036,510. ELECTRIC FUSE; T. E. Murray, New York, N. Y. App. filed May 2, 1912. A fuse strip is wound on a refractory core and placed between two contacts.